EPA/ROD/R03-90/083
1990

EPA Superfund
Record of Decision:

U.S. TITANIUM
EPA ID: VAD980705404
OU 01
PINEY RIVER, VA
11/21/1989

United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R03-90/083
November 1989

Superfund Record of Decision:

U.S. Titanium, VA

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/ROD/R03-90/083	2.	3. Recipient's Accession No.

4. Title and Subtitle
SUPERFUND RECORD OF DECISION
U.S. Titanium, VA
First Remedial Action - Final

5. Report Date 11/21/89

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Organization Name and Address

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.
(C)
(G)

12. Sponsoring Organization Name and Address
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

13. Type of Report & Period Covered 800/000

14.

15. Supplementary Notes

16 Abstract (Limit: 200 words)

The 175-acre U.S. Titanium site, in Nelson County, Virginia, is a former titanium dioxide manufacturing plant which was operated from 1931 to 1971. The facility has had a succession of owners and is currently owned by U.S. Titanium Corporation. Approximately 50 acres of the site will be addressed by this remedial action, including seven waste storage areas containing process wastes. These seven areas include: Area 1, a burial pit containing 16,000 cubic yards of solid ferrous sulfate (copperas); Area 2, a former copperas stockpile area; Area 3, an evaporation pond; Area 4, a 1-acre ore waste pile; Area 5, sedimentation ponds containing fine-grained sediment composed of unreacted ore, filter cake, and gypsum; Area 6, a settling pond used to recover phosphate ore; and Area 7, a drainage area, which received surface water runoff. Several of these areas lie within the 100-year floodplain of the nearby Piney River. After a large fish kill in 1979, the State ordered U.S. Titanium to bury the copperas waste from Area 2 by December 1980. The copperas waste was collected and buried in Area 1, the onsite burial pit. A supplemental remedial investigation revealed the presence of acidified soil underlying the waste storage areas that contributes to ground water contamination. The primary contaminants of concern affecting the soil, ground water,

(See Attached Page)

17. Document Analysis a. Descriptors
Record of Decision - U.S. Titanium, VA
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Contaminated Medium: soil, gw, sw
Key Contaminants: metals (arsenic, chromium); other inorganics (acids)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 146
	20. Security Class (This Page) None	22. Price

(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

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First Remedial Action - Final

Abstract (Continued)

and surface water are metals including arsenic and chromium; and other inorganics including acids.

The selected remedial activities for the seven areas within this site include: Area 1, in-situ dissolution of copperas waste and treatment of resulting leachate using physical and chemical processes; Areas 2, 3, 4, and 5, diversion of surface water flow using drainage controls followed by revegetation; and Area 7, excavation and neutralization of acidified soil, followed by placement of the mixed material around a wetland that will be constructed onsite. Area 6 requires no remedial action. Ground water will be collected passively using subsurface drains and trenches and treated passively in an oxidation/settling pond, a constructed wetland, and a limestone neutralization bed. The oxidation/settling pond will be capable of completely removing iron and sulfur elements from the collected ground water and will make up for any loss in the performance of the wetland. Wetland vegetation and anaerobic bacteria will remove iron and sulfur species from the water. As a result of this process, an increase in pH can be expected. The limestone bed will act as a final polishing step for pH adjustment before the effluent is discharged to the Piney River. The estimated present worth cost for this remedial action is $5,895,000, which includes present worth O&M costs for 30 years.

PERFORMANCE STANDARDS OR GOALS: Action levels for in-situ dissolution and leachate collection for Area 1 will ensure that leaching of contaminants to ground and surface waters will not exceed State water quality standards which include arsenic 0.19 mg/l and chromium 0.011 mg/l. Effluent limits for discharge from the ground water treatment system into the surface water include iron 97,583 mg/l and pH ranging from 6.0 to 9.0

RECORD OF DECISION

U. S. TITANIUM SUPERFUND SITE
NELSON COUNTY, VIRGINIA

PREPARED BY
VIRGINIA DEPARTMENT OF WASTE MANAGEMENT
OCTOBER, 1989

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PART A

DECLARATION

DECLARATION

SITE NAME AND LOCATION

U. S. Titanium
Nelson County, Virginia

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the U. S. Titanium Superfund site, Nelson County, Virginia, developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Contingency Plan (NCP). This decision is based on the administrative record for this site. An index of the administrative record upon which the selection of the remedial action is based is attached.

Both the Commonwealth of Virginia and the Environmental Protection Agency (EPA) support the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present a current or potential threat to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

This action addresses all known sources of contamination at the site, specifically acidic discharge to the Piney River. The remedy includes elimination of buried copperas waste, and remediation of contaminated groundwater. The major components of the selected remedy include:

- Dissolving the buried copperas waste in place and treating the generated leachate aboveground;

- Stabilizing other areas of the site by implementing drainage controls and establishing vegetative covers;

- Collecting groundwater at the bottom of the slope and treating it using a combination of chemical and biological (wetland) processes;

- Liming of acidified soil in areas associated with the implementation of groundwater treatment;

- Diverting surface run-off from groundwater treatment areas and former sedimentation ponds;

- Installing 100-year flood protection around the former sedimentation ponds and groundwater treatment areas;

- Installing security fences around waste and groundwater treatment areas; and

- Conducting environmental monitoring to ensure the effectiveness of the remedial action.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective. By eliminating the copperas waste through treatment and by collecting and treating contaminated groundwater, this remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility or volume as a principal element and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

However, because treatment of other less major contaminant sources was not found to be practicable, and contaminants would be accumulated in the wetland during groundwater treatment, the selected remedy could result in hazardous substances remaining on site above health based levels. Consequently, a review will be conducted within five years after the commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Regional Administrator

11/21/89

Date

VIRGINIA DEPARTMENT OF WASTE MANAGEMENT

Executive Director

3 NOVEMBER 1989

Date

PART B

DECISION SUMMARY

DECISION SUMMARY

SITE NAME AND LOCATION

The U. S. Titanium Site is located at the southern border of Nelson County along the north bank of the Piney River and east of Virginia Route 151, about 40 miles south of Charlottesville, in west central Virginia. The center of the site is located approximately at longitude 79˚ 01' 00" West and latitude 37˚ 42' 30" North. The site lies just east of the rural community of Piney River, Virginia. Figure 1 shows the general location of the site on the USGS Piney River 7.5' quadrangle topographic map.

The U. S. Titanium site lies on 175 acres of a former titanium dioxide manufacturing plant. Superfund remedial efforts are concerned with approximately 50 acres of the site. This acreage contains seven separate and distinct areas which were identified as possible sources of contamination and are described below. A site map is shown in Figure 2.

Area 1 is a clay lined, clay capped burial pit where copperas (ferrous sulfate) from Area 2 was landfilled in 1980. It encompasses approximately two acres and contains about 16,000 cubic yards of copperas.

Area 2 is the former copperas stockpile area located on the slope east of Area 3. It covers approximately eight acres. Copperas from manufacturing operations was deposited here from 1949 to 1971. The copperas was buried in Area 1 in 1980.

Area 3 contained the evaporation pond operated between 1974 and 1980 and is located between Area 1 and Area 2. This pond, which covered about two acres, was part of a system to prevent discharges to the Piney River operated under a No-Discharge Certificate issued by the Virginia Water Control Board (VWCB). Surface water run-off and some groundwater discharges were collected in a containment pond and pumped up to the evaporation pond.

Area 4 is an unreacted ore waste pile located south of Area 2. It covers about one acre and consists of clean-outs from reactor vats used in the titanium dioxide process and dredged material from the sedimentation ponds in Area 5.

Area 5 contains two sedimentation ponds located along the Piney River used to remove settleable solids from plant wastewater prior to discharge to the river. The ponds cover an area of approximately seven acres and contain an extremely fine-grained sediment composed of unreacted ore, filter cake, and gypsum. This area lies within the 100-year floodplain of the Piney River.

Area 6 contains a settling pond used to recover phosphate ore, a by-product from titanium dioxide production. It covers about one acre and is located north of Area 5.

Area 7 is the drainage area receiving most of the surface water run-off from the site and the flow from tributaries. This area is located in the southeast corner of the site and covers about one acre. This area lies within the 100-year floodplain of the Piney River.

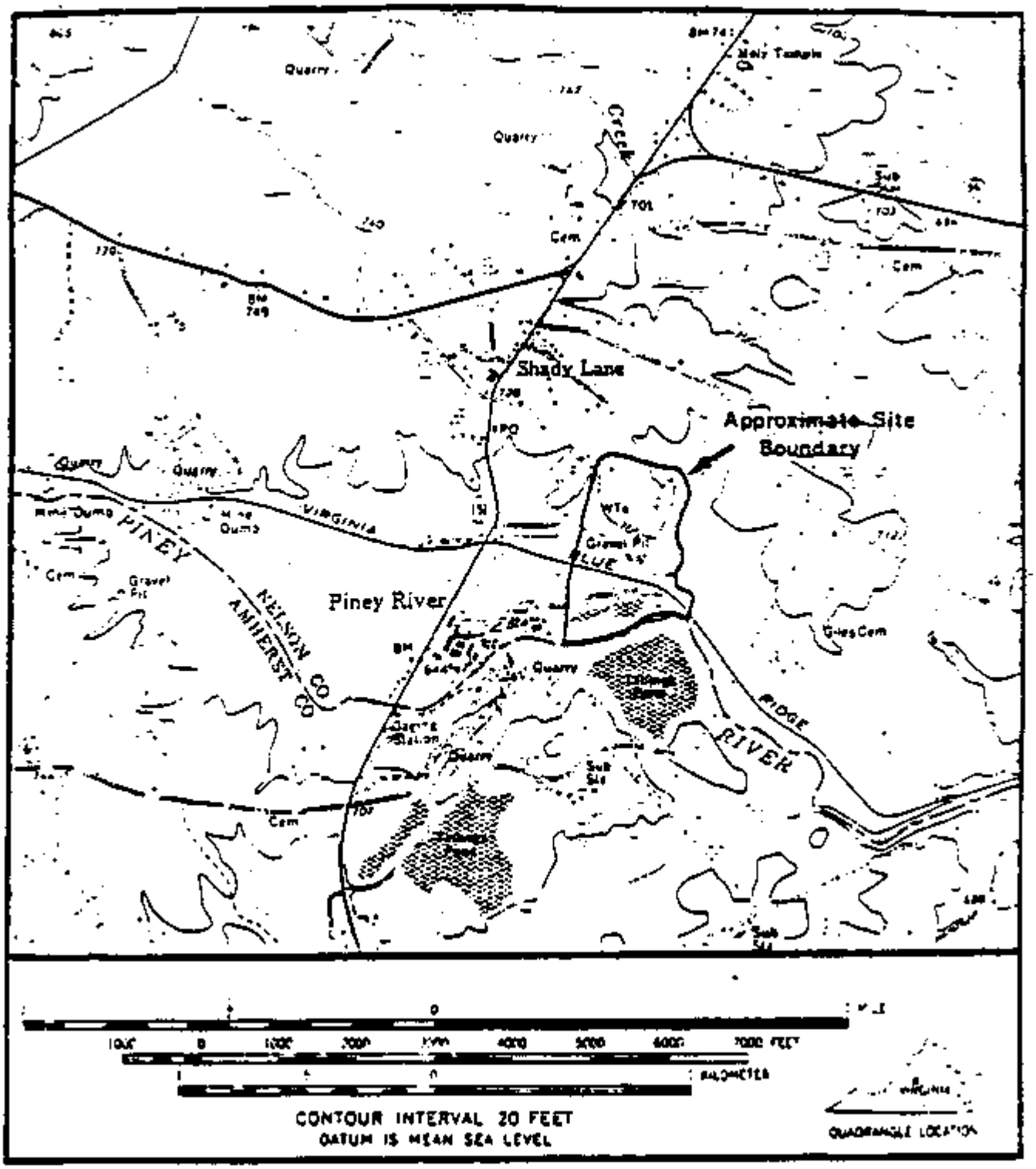


Figure 1: Location Map for the U. S. Titanium Site in Nelson County, Virgina.

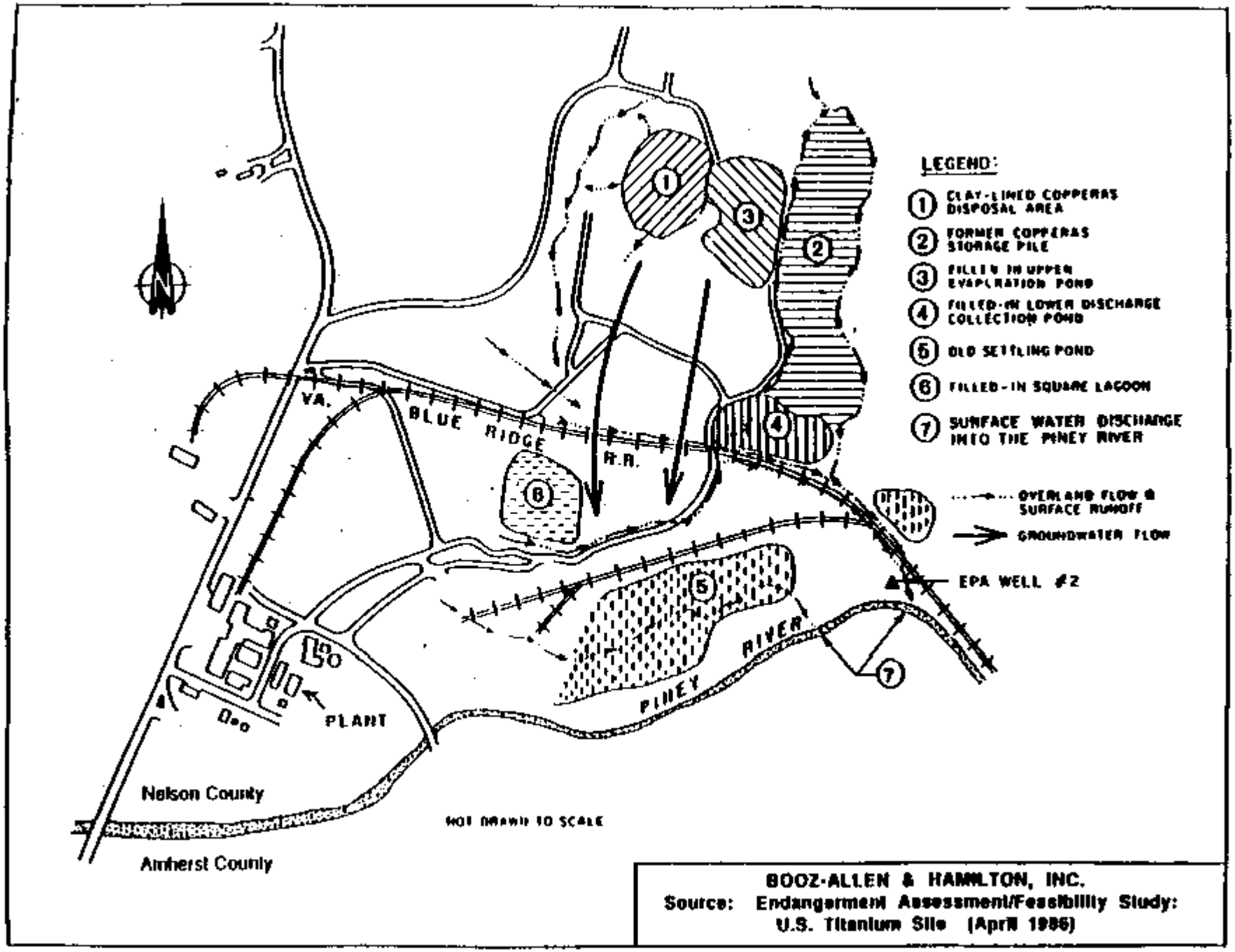


Figure 2: U. S. Titanium Site

SITE HISTORY AND ENFORCEMENT ACTIVITIES

In 1931, the Virginia Chemical Corporation began producing titanium dioxide from ilmenite ore using the sulfate process at the site. The ore was obtained from mining operations directly south of the Piney River. In the sulfate process, the ilmenite ore is treated with sulfuric acid to dissolve the titanium dioxide product. Waste streams from this process include acid contaminated unreacted ore, spent sulfuric acid, and solid ferrous sulfate, called “copperas.”

In July 1944, American Cyanamid Corporation purchased the Virginia Chemical Corporation and operated the plant until it closed in June 1971. Following the plant closure, the site passed through various ownerships including the U.S. Titanium Corporation from which the site received its name.

Six major fish kills occurred in the Piney River between 1977 and 1981, as documented by the VWCB, which were attributed to contamination from the site:

DATE	NUMBER OF FISH KILLED
July 1977	73,056
August 1977	8,940
August 1979	26,136
July 1980	53,980
May 1981	20,482
June 1981	46,243
TOTAL	228,837

The 1979 fish kill prompted the VWCB to request the Circuit Court of Nelson County to order U. S. Titanium to bury the copperas by December 31, 1980. In response to the court order, U. S. Titanium Corporation contacted New Enterprise Construction Co. to dispose of the copperas waste. The copperas waste from the storage pile (Area 2) was collected and then buried in Area 1.

Under contract with EPA, Ecology and Environment submitted a Preliminary Assessment report of the site on August 3, 1980. The burial of Copperas in Area 1 was completed on December 12, 1980. A report of a screening Site Inspection conduced by EPA on August 3-4, 1982, was released on November 19, 1982. In December 1982, the U. S. Titanium site was proposed for inclusion on the National Priority List pursuant to Section 105(8) of CERCLA. The site way finally listed on the NPL in September, 1983.

On February 1 and 2, 1983, NUS Corporation, under contract with EPA, conducted a site inspection as part of a Remedial Action Master Plan which was released in August, 1983. GCA Corporation, under contract with EPA also conducted a Focused Feasibility Study on the nature and extent of the acidic discharges from the site and evaluated alternative remedial actions. The report was released by EPA on October 8, 1985.

Following a civil action filled by the Commonwealth of Virginia against American Cyanamid Company and others in State Court, based on a nuisance action for fish kills and environmental degradation resulting from the site, a liability judgement was rendered against American Cyanamid on November 7, 1985.

On April 30, 1986, the Attorney General for the Commonwealth of Virginia and American

Cyanamid Company signed a Stipulation and Order establishing a schedule for completion, by American Cyanamid Company, of a temporary source control action for the copperas burial pit, a Supplemental Remedial Investigation (SRI), and a Feasibility Study (FS) for the site. The SRI, and FS were conducted by Hydrosystems under contract with Cyanamid Company and submitted in November 1988 and April 1989 respectively. The SRI characterized the nature and extent of contamination at the site. The FS described various cleanup technologies and how remedial alternatives were developed, screened, and evaluated based on these technologies.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

While the U.S. Titanium site is located in a predominantly rural area, there has been considerable interest among residents since the late 1970's, when fish kills began to occur. The local Blue Ridge Chapter of the Sierra Club was formed in response to site events. In addition, the local media have followed the site activities consistently.

The post-RI/FS community participation activities began in April, 1989, when a fact sheet describing the Remedial Investigation/Feasibility Study was mailed to a list of residents, officials, and media. In addition, informal meetings were held with local officials and Sierra Club representatives on May 18. The Community Relations Plan (CRP) was revised at this time, and a repositories for the Administrative Record File and other information was established at the Nelson County Memorial Library and the County Administration office. The Proposed Plan was formally released to the public on July 31. A notice announcing the availability of the Proposed Plan, the public comment period, and the Administrative Record File was published in the Charlottesville Daily Progress on July 31. The Virginia Department of Waste Management (VDWM) also cosponsored an informal workshop for Sierra Club members and other interested citizens on July 31, to explain the Superfund process, resources available to the public, and outline the Proposed Plan.

The public comment period extended from July 31 through September 29, after a 30-day extension was granted at the request of American Cyanamid. A public meeting was held on August 9, where VDWM and EPA representatives reviewed the Proposed Plan and Superfund public participation opportunities in detail. The meeting lasted four and a half hours, and the interest level of the community was very high. A formal response to questions and comments put forth during the public meeting and comment period can be found in Part III of this document, the Responsiveness Summary. Community participation activities will continue through remedial design and remedial action.

A detailed outline of community relations activities undertaken with the U.S. Titanium site community can be found in the Responsiveness Summary (Appendix A). All studies and documents pertaining to this site can be found in the Administrative Record Files, upon which the decision for choosing remedial alternatives was based.

SCOPE AND ROLE OF RESPONSE ACTION

The Supplemental Remedial Investigation (SRI) characterized the nature and extent of contamination at the site. The SRI data as well as data and/or conclusions from all previous studies were used in the Feasibility Study (FS) to develop remedial alternatives to eliminate unacceptable risks at the site. The FS described various cleanup technologies and how remedial alternatives were developed, screened, and evaluated based on these technologies.

Contaminant source control was identified during the RI as the most effective way of eliminating risk to human health and the environment at the U.S. Titanium site. Consequently, the FS focused on the development of remedial alternatives designed to control contaminant sources identified during the RI. The selected alternative in this Record of Decision (ROD) includes a source control remedy for all areas of the site currently impacting groundwater and surface water discharging from the site into the Piney River.

Significant data were also generated during the RI on the migration of site-related contaminants from the identified sources. In particular, the RI indicates that site related contaminants are migrating into groundwater. The ROD therefore includes groundwater remediation.

By eliminating most of the sources of acidic discharge, the proposed remedial action will prevent future fish kills, and stop further degradation of the Piney River.

SITE CHARACTERISTICS

Based on the findings of the SRI and previous site investigations, the following conclusions can be made regarding the site, the types of contamination, and affected media.

The site is located in the Piedmont physiographic province, about five miles east of the Virginia Blue Ridge. The elevation ranges from 726 feet on top of the copperas burial pit in Area 1 to 618 feet in the Piney River near the drainage area (Area 7). The bedrock underlying the site consists of igneous and metamorphic rocks. Two distinct sets of nearly vertical fractures are present in the bedrock and have approximately northwest-southeast and northeast-southwest orientations.

Two soil groups exist at the site. In the upland areas, the soil is a residuum (saprolite) derived from the weathering of the underlying parent bedrock material. It is composed predominantly of clays and silts. Within the floodplain, the soil consists of heterogeneous alluvial deposits of gravel, sand, silt, and clay. In general, the soil depth decreases from near 60 feet at the top of the slope in Area 3, to less than one foot near the stream at the base of Area 2.

Groundwater occurs primarily in the porous, unconsolidated granular material of the saprolite and, to a much lesser extent, in the fractures that run through the dense, hard igneous and metamorphic bedrock. These two units are hydraulically interconnected over larger distances. The depth to water table is about 44 feet on the south side of Area 1. Coming down the valley, the water table becomes shallower, intersecting ground surface in the stream beds and springs along the base of the hill. Groundwater flow within the site originates in the upland area containing Areas 1 and 3, flows in a radiating pattern down hill toward the streams surrounding the base of the hill and to the Piney River.

The site lies within the Piney River drainage basin, a part of the larger James River drainage basin. Areas 5 through 7 lie within the floodplain of the Piney River. Surface water drainage runs off the site primarily via three drainage channels into the Piney River.

In Area 1, the copperas burial pit, the cap system has not functioned properly allowing water to infiltrate the pit. The resultant acidic and high iron content leachate has acidified soils underneath the pit and contaminated groundwater. Acidic seepages from the burial pit have killed trees and other vegetation down-gradient from Area 1. This area accounts for about 65 percent of the total acidic discharge at the site. Analysis of groundwater samples down-gradient of the burial pit have shown a pH as low as 3.66, and concentrations of total dissolved iron of up to 2190 mg/l, sulfate of up to 14,000 mg/l, and acidity of up to 10,050 mg/l as calcium carbonate.

The soil under the former copperas stockpile area, Area 2, is acidified and groundwater seepages at the base of the slope have killed the grass stand and formed iron sulfate deposits. The acidic contribution from this area is 11 percent. Analyses of samples from seeps at the base of Area 2 have shown a pH as low as 2.66, and concentrations of total dissolved iron of up to 17,720 mg/l, sulfate of up to 45,000 mg/l, and acidity of up to 41,000 mg/l as calcium carbonate.

The soil under Area 3, the former evaporation pond, is acidified up to the water table. Total acidic contribution from this area is about 7 percent. The most recent analysis of groundwater from a well located within Area 3 has shown a pH of 3.32, and concentrations of total dissolved iron of 4,360 mg/l, sulfate of 54,000 mg/l, and acidity of 40,500 mg/l as calcium carbonate.

Area 4, the unreacted ore waste pile area, contains residual acidity from processing. The soil underneath this area is also acidified. Four percent of total acidity at the site is attributable to this area.

Area 5, which contains the two sedimentation ponds, contains residual acidity from processing. During storm events, erosion of sediments by storm run-off has resulted in a significant lowering of the pH in the Piney River. In addition, groundwater flowing through this area is acidified by contact with the waste prior to discharge to the Piney River. Area 5 accounts for 12 percent of the total acidity at the site. Analyses of samples from wells located on the northeastern edge of this area have shown a pH as low as 3.42, and concentration of total dissolved iron of up to 1,840 mg/l, sulfate of up to 5,400 mg/l, and acidity of up to 3,220 mg/l as calcium carbonate.

Area 6, the settling pond used to recover phosphate ore has no detectable copperas or acidity problem. There is also no groundwater contamination.

The soil under Area 7, the drainage area receiving most of the surface run-off from the site, has become acidified and contributes about one percent to total site acidity. Analysis of samples from a well down-gradient of Area 7, have shown a pH as low 3.09, and concentrations of total dissolved iron of up to 570 mg/l, sulfate of up to 2,400 mg/l, and acidity of up to 1,542 mg/l as calcium carbonate.

The acidic nature of the site has also led to the leaching of other metals such as aluminum, copper, zinc, cadmium and nickel from on site soils. The concentration of these metals in surface water and groundwater at the site, as well as that of iron, exceed surface water criteria (Table 1). Figure 3 shows the percentage contribution by area to acidic contamination at the site.

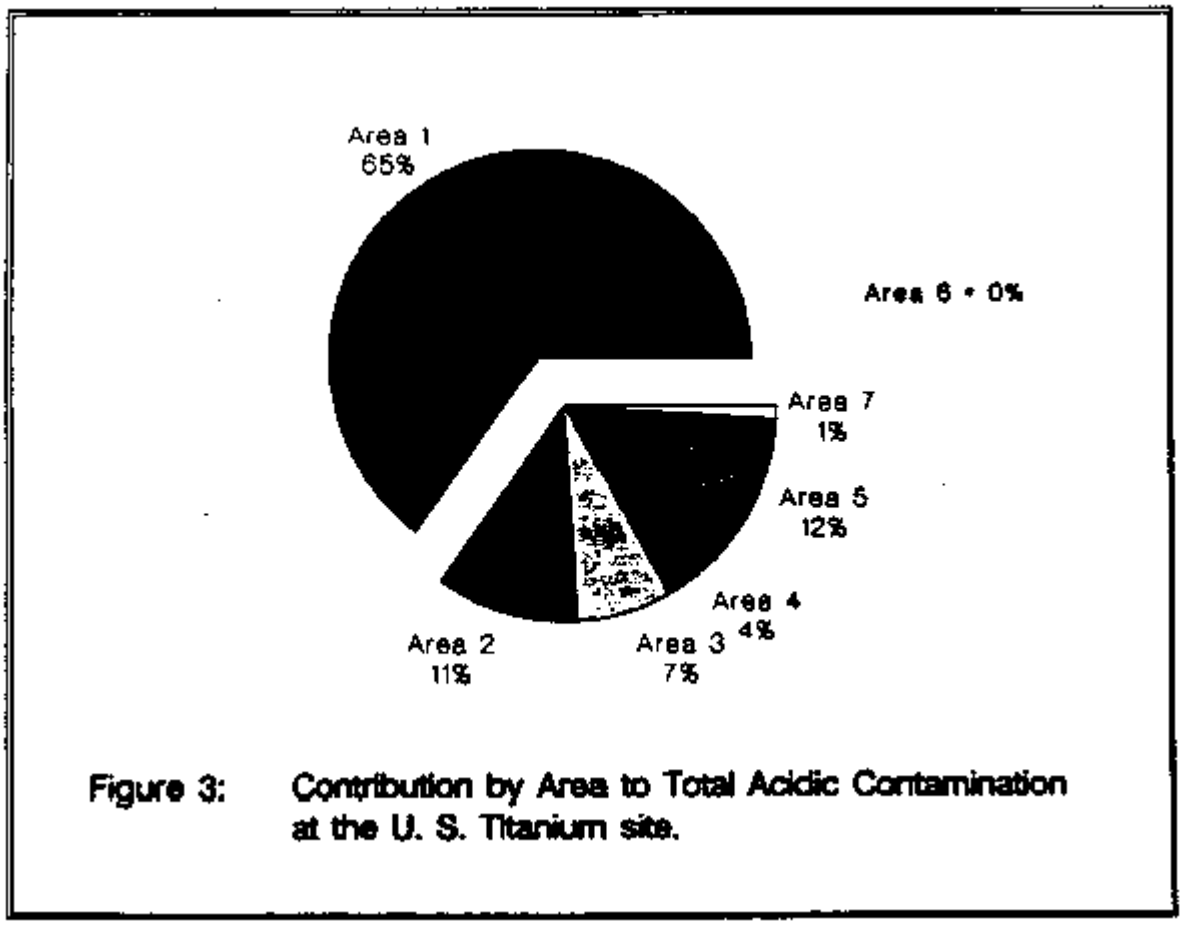


Figure 3: Contribution by Area to Total Acidic Contamination at the U. S. Titanium site.

TABLE 1: MEAN CONCENTRATION IN SURFACE WATER DISCHARGE & GROUNDWATER AT THE U. S. TITANIUM SITE

Units in mg/l

Contaminants	Surface [a] Water Discharge	Ground [b] Water	Surface [c] Water Criteria
Al	200.	200.	0.087[d]
As[e]	<0.01	0.028	0.190
Cd	0.013	0.047	0.0003
Cr	0.335	0.084	.011[f]
Cu	1.355	0.45	0.0025
Ni	0.692	2.67	0.023
Zn	1.56	19.27	0.047
Iron	267.	698.	1.0
pH	2.4	3.1	6-9
Acidity	1446	2090	-

a. Source: Report by J. Novak, Virginia Tech (1984)
b. Source: Morris, Ph.D. Thesis, Virginia Tech (1984)
c. Source: Virginia Water Control Board
d. Source: USEPA Ambient Water Quality Criteria (1988)
e. Source: NUS (1983)
f. Cr(VI) (total recovery)

SUMMARY OF SITE RISKS

Without remedial action, the site will continue to contaminate groundwater and surface water in the Piney River sub-basin. Acidified soils and buried copperas wastes will continue to leach contaminants into the groundwater. The dissolution of copperas produces acidity as the result of a sequence of reactions that include oxidation, of the ferrous iron to ferric iron, and hydrolysis of the ferric iron to ferric oxyhydroxide. The net effect of these reactions is that for every mole of copperas dissolved, two moles of excess hydrogen iron (H^+) are produced resulting in the acidic leachate. Groundwater eventually discharges into the Piney River either directly or by way of two site tributaries. Surface water run-off from the site erodes acidic sediments and discharges them into the river.

These discharges can contain high iron concentrations and have low pH values. The high iron concentrations have resulted in the deposition of ferric hydroxide sediments at the bottom of the river. These sediments are still present today and have disrupted the benthic community in the river. This in turn has resulted in a decrease in the number and diversity of the fish population in the river adjacent to and downstream of the site. Low pH discharges can be toxic to aquatic organisms. Based on sampling as late as fall 1988, the State Water Control Board has concluded that the aquatic invertebrate community has not completely recovered in the Piney River even at a distance of 3.5 miles downstream.

Actual or threatened releases of pollutants from this site, if not addressed by implementing the response action selected in this ROD, may present substantial endangerment to aquatic life in the Piney River.

DESCRIPTION OF ALTERNATIVES

Several alternatives were evaluated in detail to determine which would be most effective in achieving the goals of CERCLA, and in particular, achieving the remedial objective for the site. The detailed analyses remedial alternatives for the various areas of the site are briefly described below.

NO ACTION

Capital Costs:	$ 21,000*
Annual O & M:	$156,000*
Five Year Review:	$133,000*
Months to Implement:	3*

The Superfund program is required to evaluate the "No Action" alternative. Under this alternative, no remedial action would be taken to prevent contamination from entering groundwater or the Piney River. Site access controls, deed restrictions, and maintenance of on site roads would be performed. In addition, monitoring of the groundwater and surface water would be performed along with a formal review of the site condition every five years. ARARs associated with surface water and groundwater would not be attained.

The remedial objectives for the site would not be met by the no action alternative and impacts on the benthic community in the Piney River would continue. The no action alternative does not meet SARA's preference for permanent treatment.

GROUNDWATER COLLECTION SYSTEM

Alternative GW-2: Passive Groundwater Collection

Capital Costs:	$142,000*
Annual O & M Costs:	$2,000*
Months to Implement:	3*

Groundwater would be intercepted by a series of subsurface drains and/or trenches installed below the water table along the base of the hill containing Areas 1, 2, 3, and 4. Gravity flow would be used to feed the collected water to the groundwater treatment system. Measures would be taken to prevent the formation of iron salt deposits in the collection system during periods of low flow. Uncontaminated surface water run-off would be diverted away from the collection system.

Groundwater would be collected for treatment until the groundwater quality achieves a level which allows it to be discharged directly into the Piney River. The discharged limits for this site necessary to meet water quality standards in the Piney River and so comply with the Clean Water Act (CWA) and Virginia Water Control Board (VWCB) regulations have been determined by VWCB and are presented in Appendix I.

* All costs and implementation times are estimated.

GROUNDWATER TREATMENT SYSTEM

Alternative WT-2: Passive Water Treatment

Capital Costs:	$119,000*
Annual O & M Costs:	$20,000*
Months to Implement:	6*

The components of the treatment system would include an oxidation/settling pond, a constructed wetland, and a limestone neutralization bed.

The oxidation/settling pond would be capable of complete removal of iron and sulfur elements from the collected groundwater. Its design would utilize existing knowledge of acid mine drainage treatment where the use of oxidation/settling ponds is a standard technique. Such treatment systems often utilize alkaline chemicals to raise the pH of the water and cause metals to precipitate. The sulfur element would also be precipitated. The oxidation/settling pond would make up for any loss in the performance of the wetland.

Wetland vegetation works in conjunction with anaerobic bacteria to remove iron and sulfur species from the water; an increase in the pH can also be expected. The wetland would be protected from a 100-year flood by constructing a berm around it.

Should the presence of other metals in the effluent from the wetland make the discharge requirements set by the VWCB non-attainable and thus prevent direct discharge into the Piney River, additional physical or/and chemical treatment steps would be installed.

The limestone bed would act as a final polishing step for pH adjustment before discharge of the effluent to the Piney River.

An eight-foot high, locked chain-link fence would be installed around the wetland for the protection of the community, on site workers, and game and wildlife. Routine maintenance of the entire groundwater system would include restocking of the wetland with new plants, dredging of the oxidation pond and wetland, periodic effluent and influent monitoring. The monitoring program for groundwater treatment is presented in Appendix I.

All residual wastes would have to undergo Extraction Procedure Toxicity (EP Tox) testing to determine their classification before disposal. Wastes that fall under RCRA Subtitle C (Hazardous Waste) would be managed according to the Virginia Hazardous Waste Management Regulations (VHWMR) and applicable RCRA Land Disposal Restrictions (LDRs). Wastes that are classified as RCRA Subtitle D (Solid Waste) would be managed according to the Virginia Solid Waste Management Regulations (VSWMR). The oxidation/settling pond, the wetland and the neutralization bed would be constructed and operated according to VHWMR or VSWMR (including minimum technology requirements). The Commonwealth of Virginia is a RCRA delegated State. All RCRA authority has been delegated to the Commonwealth of Virginia except those under the 1984 Hazardous and Solid Waste Amendments (HSWA).

* All costs and implementation times are estimated.

Alternative WT-3: Active Water Treatment

Capital Costs:	$2,735,000*
Annual O & M Costs:	$181,300*
Months to Implement:	18*

The system would consist of a series of ponds and tanks used for oxidation, neutralization, mixing, aeration, and solids separation. The ferrous ions would be oxidized to ferric ions and the resulting acidity neutralized. Sludge from the solids separation operation would be subjected to EP Tox testing to determine if its disposal should follow the VHWMR and the LDRs or the VSWMR. The effluent from the active treatment system must also meet the discharge requirements established by the VWCB.

AREA 1

Alternative A1-3: Clay Cap

Capital Costs:	$486,000*
Annual O & M Costs:	$3,000*
Months to Implement:	12*

The copperas and contaminated soil would be left in place and a new clay cap would be installed over the existing cap. The present surface would be graded and compacted. The cap would consist of a three foot thick clay layer, a one foot thick drainage layer, and two feet of soil to support a vegetative cover. The cap could reduce the production leachate from the burial pit by over 90 percent.

Routine maintenance to repair erosion damage, cracks, and subsidence in the cap would be required consistent with the requirements of RCRA as long as the copperas remains in the burial pit. The cap would be constructed and maintained in accordance with the VSWMR, including minimum technology requirements. Deed restrictions would also be applied.

Alternative A1-4: Impermeable Cap

Capital Costs:	$511,000*
Annual O & M Costs:	$3,000*
Months to Implement:	12*

This alternative is similar to A1-3. This cap structure would consist a two foot thick clay layer, a synthetic membrane liner, a one foot thick drainage layer, a geotextile filter fabric, and a two foot thick vegetative cover. This cap could reduce the production of leachate from the burial pit by nearly 100% during the 30 year life of the synthetic membrane.

Routine maintenance to repair erosion damage, cracks, and subsidence in the cap would be required consistent with the requirements of RCRA as long as the copperas remains in the burial pit. The cap would be constructed and maintained in accordance with the VSWMR, including minimum technology requirements. Deed restrictions would also be applied.

* All costs and implementation times are estimated.

Alternative A1-8: Above-Grade Wet Neutralization

Capital Costs: $10,779,000*
Annual O & M Costs: $434,000*
Months to Implement: 18 (4.5 yrs total treatment time)*

The alternative would consist of the following major steps: (1) excavation of the soil/copperas mixture from the burial pit; (2) dissolution of the copperas from the soil; (3) oxidation of the ferrous ions to ferric ions; (4) neutralization of the acidity resulting from the oxidation step; (5) disposal of precipitated solids generated in the neutralization step. This treatment would result in the destruction of the copperas and neutralization of the resulting acidity. In addition, the concentration of contaminated groundwater routed to the groundwater treatment system would be greatly reduced.

The effluent from the treatment system must meet the discharge requirements established by the VWCB. Solids generated by the process would be subjected to EP Tox testing to determine if its disposal should follow the VHWMR and the LDRs or the VSWMR.

Alternative A1-9: Neutralization and Capping

Capital Costs: $1,234,000*
Annual O & M Costs: $3,000*
Months to Implement: 18*

The existing clay cap would be removed. Soda ash, a neutralization agent, would be mixed with the soil/copperas waste to a depth of five feet. A clay cap identical to that described in Alternative A1-3 would then be installed. The cap could reduce the production of leachate from the burial pit by over 90 percent. The soda ash would provide some neutralization of any leachate generated.

RCRA Subtitle D closure standards, Virginia Department of Waste Management's Solid Wastes Regulations, and deed restrictions would be applied. Routine maintenance to repair erosion damage, cracks, and subsidence in the cap would be required consistent with the requirements of RCRA as long as the copperas remains in the burial pit.

Alternative A1-10: In-Situ Dissolution and Treatment

Capital Costs: $3,457,000*
Annual O & M Costs: $210,000*
Months to Implement: 30*

The alternative would consist of the following major steps: (1) dissolution of copperas inside the burial pit; (2) recovery of resulting leachate from the pit; (3) complete treatment of the leachate using physical and chemical processes; (4) sludge disposal. Instead of steps 3 and 4, product recovery from the collected leachate would also be explored. The specific details of the processes would be determined in the Remedial Design phase through engineering design and analysis. The alternative would result in the destruction of the copperas and neutralization of the resulting acidity. In addition, the concentration of contaminated groundwater routed to the groundwater treatment system would be greatly reduced.

* All costs and implementation times are estimated.

The performance of the copperas dissolution step would be verified by taking core or split spoon samples from the burial pit and analyzing them for total soluble content. The efficiency of the leachate removal system would be evaluated through a water balance that takes into account the level of water in the burial pits, the amount of water introduced and the amount recovered.

The termination of in-situ dissolution and leachate collection would be determined using the results of soil boring tests, and fate and transport modeling to estimate the potential of groundwater contamination that could result from the migration of residual contaminants in the soil. The leaching process shall be stopped when (1) soil boring tests show that no significant amount of copperas remains in the pits, and (2) the residual acidity in the formation is such that if leached into groundwater and discharged into the Piney River would not violate the ARARs for the river.

To evaluate the efficiency of the treatment plant, influent and effluent samples would be taken and analyzed. Water to be re-injected into the burial pit would be analyzed for pH, sulfate and iron. In addition, water to be discharged from the treatment process would be analyzed for the specific metals listed in the water quality standards for the site.

Discharge into the wetland from Area 1 would only be allowed when the water to be discharged is comparable to the quality of influent water into the wetland and provided such additional discharge capacity would not adversely affect the performance of the wetland. In any case, no discharge would be allowed until the dissolution process is near completion.

Solids generated by the process would be subjected to EP Tox testing to determine if its disposal should follow the VHWMR and the LDRs or the VSWMR.

AREA 2

Alternative A2-4: Surface Repair of Unvegetated Areas

Capital Costs:	$83,000*
Annual O & M Costs:	$4,100*
Months to Implement:	6*

Contaminated groundwater seeps at the base of the slope in Area 2, which resulted in destruction of the vegetative cover, would be collected using subsurface drains and routed to the groundwater treatment system. Iron sulfate deposits at the base of the slope would be removed. Regrading, liming of acidified soils, and seeding would be done to re-establish a vegetative cover where necessary. This alternative would prevent precipitation of iron sulfate salts at the base of the slope, and therefore, reduce contaminant loading of surface water runoff from this area. Routine maintenance would be required.

Alternative A2-5: Impermeable Capping

Capital Costs:	$1,869,000*
Annual O & M Costs:	$9,000*
Months to Implement:	12*

* All costs and implementation times are estimated.

The cap structure would consist of a two foot thick clay layer, a synthetic membrane liner, a one foot thick drainage layer, a geotextile filter fabric, and a two foot thick vegetative cover. This cap could reduce the production of leachate from this area by nearly 100% during the 30 year life of the synthetic membrane. VSWMR would be applied. Routine maintenance to repair erosion damage, cracks, and other damage to the cap would be required.

AREA 3

Alternative A3-3: Improve Surface Drainage

Capital Costs:	$86,000*
Annual O & M Costs:	$1,300*
Months to Implement:	3*

The surface of Area 3 would be regraded, limed, and seeded to establish a vegetative cover. Regrading would improve surface water runoff from the area, and a vegetative cover would improve evapotranspiration. Both help to reduce infiltration of rain water and subsequent contamination of groundwater under this area. Routine maintenance would be required.

Alternative A3-4: Clay Capping

Capital Costs:	$352,000*
Annual O & M Costs:	$3,000*
Months to Implement:	12*

The cap structure would consist of a two foot thick clay layer and a two foot thick vegetative cover. This cap would reduce the infiltration of water by 50%. VSWMR would be applied. Routine maintenance to repair erosion damage, cracks, and other damage to the cap would be required.

Alternative A3-5: Impermeable Capping

Capital Costs:	$505,000*
Annual O & M Costs:	$3,000*
Months to Implement:	12*

The cap structure would consist of a two foot thick clay layer, a synthetic membrane liner, a one foot thick drainage layer, a geotextile filter fabric, and a two foot thick vegetable cover. This cap would reduce the production of leachate from this area by nearly 100% during the 30 year life of the synthetic membrane. VSWMR would be applied. Routine maintenance to repair erosion damage, cracks, and other damage to the cap would be required.

* All costs and implementation times are estimated.

AREA 4

Alternative 4-3: On site Disposal in a Secure Landfill

Capital Costs:	$1,452,000*
Annual O & M Costs:	$2,600*
Months to Implement:	18*

This alternative would consist of excavating 20,000 cubic yards of acidified, unreacted ore and placing the material in a landfill in Area 3. The area would be regraded, limed, and seeded to establish a vegetative cover. Implementation would greatly reduce the contamination of groundwater and erosion of acidified material in surface water runoff from this area. VSWMR and deed restrictions would be applied. Routine maintenance of the landfill cap would be required consistent with the requirements of RCRA.

Alternative A4-4: Drainage Control and Revegetation

Capital Costs:	$183,000*
Annual O & M Costs:	$1,300*
Months to Implement:	6*

This alternative involves diverting surface water flow around this area, regrading the unreacted ore pile, covering with two feet of soil cover, and establishing a vegetative cover. Implementation would reduce infiltration of water through the waste with subsequent contamination of groundwater by improving drainage and increasing evapotranspiration in the area. Routine maintenance of the vegetative cover would be required.

Alternative A4-5: Impermeable Capping

Capital Costs:	$401,000*
Annual O & M Costs:	$2,800*
Months to Implement:	12*

The cap structure would consist of a two foot thick clay layer, a synthetic membrane liner, a one foot thick drainage layer, a geotextile filter fabric, and a two foot thick vegetative cover. This cap would reduce infiltration of water to a minimum and prevent erosion of acidic materials. VSWMR and deed restrictions would be applied. Routine maintenance to repair erosion damage, cracks, and other damage to the cap would be required.

Alternative A4-7: Above-Grade Dry Neutralization

Capital Costs:	$702,000*
Annual O & M Costs:	$1,300*
Months to Implement:	6*

This alternative consists of the following steps: (1) excavation of acidified, unreacted ore; (2) addition of a neutralizing agent under dry conditions; (3) compaction of the mixed material in place; (4)

* All costs and implementation times are estimated.

place two foot soil cap over material and establish a vegetative cover. Implementation would neutralize leachate produced by infiltrating water while the vegetative cover would prevent erosion and promote evapotranspiration. VSWMR and deed restrictions would be applied. Routine maintenance of the vegetative cover would be required.

AREA 5

Alternative A5-4: Drainage Control and Revegetation

Capital Costs:	$748,000*
Annual O & M Costs:	$3,300*
Months to Implement:	6*

This alternative involves diverting surface water flow around this area, regrading the sediment, covering with two feet soil, and establishing a vegetative cover. Implementation would reduce infiltration of water through the waste with subsequent contamination groundwater by improving drainage and increasing evapotranspiration in the area. This alternative would also reduce the erosion of acidic sediment from this area into the Piney River which has been identified as a major cause of severe lowering of pH in the river.

Routine maintenance of the vegetative cover and diversion ditches would be required. Since this area lies within a floodplain, a 100-year flood protection berm would be constructed around it in accordance with the Executive Order 11988 (40 CFR 6, Appendix A - Protection of Floodplains).

Alternative A5-5: Impermeable Capping

Capital Costs:	$1,564,000*
Annual O & M Costs:	$7,000*
Months to Implement:	12*

The cap structure would consist of two foot thick clay layer, a synthetic membrane liner, a one foot thick drainage layer, a geotextile filter fabric, and a two foot thick vegetative cover. This cap would reduce infiltration of water to a minimum and prevent erosion of acidic materials. VSWMR and deed restrictions would be applied. Routine maintenance to repair erosion damage, cracks, and other damage to the cap, and a 100-year flood protection berm would be required.

Alternative A5-7: Above-Grade Dry Neutralization

Capital Costs:	$5,027,000*
Annual O & M Costs:	$3,300*
Months to Implement:	18*

This alternative consists of the following steps: (1) excavation of acidified, unreacted ore; (2) addition of a neutralizing agent under dry conditions; (3) compaction of the mixed material in place; (4) placement of a two foot soil layer over the material and establishment of a vegetative cover. Implementation would neutralize leachate produced by infiltrating water while the vegetative cover would

* All costs and implementation times are estimated.

prevent erosion and promote evapotranspiration. VSWMR and deed restrictions would be applied. Routine maintenance of the vegetative cover and a 100-year flood protection berm would be required.

AREA 6

Alternative A6-1: No Action

Because no contamination was found in this area, the no action alternative is appropriate for this area of the site.

AREA 7

Alternative A7-3: On site Disposal in a Secure Landfill

Capital Costs:	$1,205,000*
Annual O & M Costs:	$2,600*
Months to Implement:	12*

This alternative would consist of excavating 15,000 cubic yards of acidified soil and placing the material in a landfill constructed in Area 3. The area would be regraded, limed, and seeded to establish a vegetative cover. Implementation would reduce the contamination of groundwater flowing through this area and the erosion of acidified material in surface water runoff from this area. VSWMR and deed restrictions would be applied. Routine maintenance of the vegetative cover and the landfill cap would be required consistent with the requirements of RCRA.

Alternative A7-4: Drainage Control and Revegetation

Capital Costs:	$158,000*
Annual O & M Costs:	$1,100*
Months to Implement:	6*

This alternative involves diverting surface water and groundwater flow around this area, regrading the surface, covering with two feet of soil cover, and establishing a vegetative cover. Implementation would reduce infiltration of water through the soil with subsequent contamination of groundwater by improving drainage and increasing evapotranspiration in the area. This alternative would also reduce the erosion of acidic sediment from this area into the Piney River. Routine maintenance of the vegetative cover and diversion ditches and a 100-year flood protection berm would be required.

Alternate A7-5: Impermeable Capping

Capital Costs:	$348,000*
Annual O & M Costs:	$2,600*
Months to Implement:	6*

* All costs and implementation times are estimated.

The cap structure would consist of a two foot thick clay layer, a synthetic membrane liner, a one foot thick drainage layer, a geotextile filter fabric, and a two foot thick vegetative cover. This cap would reduce infiltration of water to a minimum and prevent erosion of acidic materials. VSWMR and deed restrictions would be applied. Routine maintenance to repair erosion damage, cracks, and other damage to the cap, and a 100-year flood protection berm would be required.

Alternative A7-7: Above-Grade Dry Neutralization

Capital Costs:	$286,000*
Annual O & M Costs:	$1,100*
Months to Implement:	6*

This alternative would be implemented in conjunction with the wetland process for treating groundwater. It consists of the following steps: (1) excavation of acidified soil; (2) addition of a neutralizing agent under dry conditions; (3) compaction of the mixed material; (4) placement of mixed material around the wetland as a berm and (5) establishment of a vegetative cover. Surface water run-off would be diverted away from the area. Implementation of this alternative would neutralize leachate produced by infiltrating water while the vegetative cover would prevent erosion. Routine maintenance of the vegetative cover and a 100-year flood protection berm would be required.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

This section summarizes the comparative analysis of alternatives presented in the analysis section of the RI/FS report and its addenda. The definitions of the nine point criteria used in the evaluation are presented in Appendix II.

Overall Protection

The In-Situ Dissolution and Treatment (A1-10) and the Above-Grade Wet Neutralization (A1-8) alternatives would be protective of human health and the environment by providing permanent and complete treatment of the waste in Area 1, the area of the site contributing the greatest percentage of contamination to groundwater as identified in the SRI. All the other alternatives examined for Area 1 would not be protective because they involve the continual presence of copperas in the soil. Copperas in Area 1 accounts for two thirds of the acidic problem at the site.

The alternatives of Capping, and Drainage Controls and Revegetation examined for the remaining areas of the site would be protective by reducing the amount of contamination reaching groundwater and eliminating erosion of acidic material by surface water run-off from the site. Groundwater collection and treatment alternatives would also be protective of human health and the environment.

The No Action alternative would not be protective of human health and the environment because contaminant levels in the soil and groundwater would continue to exceed levels protective of the shallow aquifer (which discharges into the Piney River) and the Piney River (Table 1).

Compliance with ARARs

The In-Situ Dissolution and Treatment, and the Above-Grade Wet Neutralization alternatives for Area 1 would meet chemical, location and action specific ARARs. The disposal of solid wastes from these alternatives would comply with the VHWMR and the RCRA-LDRs or the VSWMR. All applicable or relevant and appropriate requirements (ARARs) of Federal and State laws for surface water would also be met. Monitoring of the effluent from the groundwater treatment system and any discharge from the chemical treatment systems for Area 1 would be required to assure compliance with the discharge limits established by the VWCB. Remedial alternatives for Areas 5 and 7 would also comply with Federal and State Laws for the protection of floodplains.

Long-term Effectiveness and Permanence

The In-Situ Dissolution and Treatment, and the Above-Grade Wet Neutralization alternatives for Area 1 would provide for permanent treatment of the most contaminated waste on the site. By completely treating the waste in Area 1, the major source of groundwater contamination would be eliminated.

Capping the waste would not provide for a permanent solution. The cap installed previously has not functioned properly allowing water to infiltrate the waste. Because a substantial amount of water has entered the burial pit, compaction of the waste to support the new cap may no longer be possible. Because of the high solubility of the copperas waste, the possibility of the cap failing would

always exist as long as the waste remains in the burial pit. An aggressive maintenance program beyond the proposed biannual inspections described in the FS would be required to ensure the integrity of the cap system, especially during the first several years after installation.

Groundwater collection and treatment alternatives would provide long-term effectiveness and permanence as long as the major source of contamination in Area 1 is eliminated. The alternatives proposed for the other areas of the site would also be effective as long as proper operation and maintenance is performed as per plan design.

Reduction in Toxicity, Mobility, or Volume of the Contaminants through Treatment

The In-Situ Dissolution and Treatment, and the Above-Grade Wet Neutralization alternatives for Area 1 would provide for reduction in toxicity, mobility, and volume of waste in Area 1 through treatment. Approximately 35,000 cubic yards of soil/copperas mixture would be treated. The treatment would completely neutralize the acid producing potential of the waste. A decrease in the mobility of iron-containing contaminants by reducing their solubilities in water would also be achieved. This treatment is expected to be irreversible so that the original contaminants could not be regenerated.

The groundwater treatment system would provide for a reduction in toxicity of the collected contaminated groundwater. The alternatives proposed for the other areas would provide a reduction in mobility of the contaminants. However, the capping solution would not reduce the volume or toxicity of the contaminants. The establishment of a vegetative cover at various areas of the site would reduce erosion of acidic materials by surface water run-off.

Short-term Effectiveness

The short-term impact of implementing any of these alternatives to the surrounding community should be minimal. No volatile contaminants exist on the site and dust generation should be insignificant. Impact on workers should also be minimal. Implementation of the In-Situ Dissolution and Treatment, and the Above-Grade Wet Neutralization alternatives would have to be engineered to minimize the risk of soil/copperas waste being carried by surface water runoff into the Piney River. Implementation of the other alternatives would not pose any short term risks. In addition, the implementation a drainage controls and revegetation at several areas of the site should have an immediate impact in controlling contaminant discharges from the site.

Approximately 30 months would be required to implement the In-Situ Dissolution and Treatment alternative. The other alternative can be implemented in less than 18 months.

Implementability

All of the alternatives utilize reliable, demonstrated technologies. Treatment of the copperas waste above ground will not inhibit any future actions that might be necessary. Capping of the area will result in a substantial increase in material to move and possibly treat if additional work becomes necessary.

Because some construction will be performed in the floodplain of the Piney River, a review of the designs plans may be required by state and country agencies. Coordination of activities with the

VWCB should not create any delays because of the agency,s extensive involvement at the site in the past. No other administrative difficulties are anticipated. Contractors and materials to perform the work are readily available. No special equipment or supplies should be required.

Costs

A summary of costs for the remedial alternatives is shown in Table 2. Costs shown are in $1,000's and represent the total of capital costs and 30 year present worth of annual O & M costs. The No Action costs would apply to the entire site, not just Area 1.

Support Agency Acceptance

The Commonwealth of Virginia accepts the recommended alternative as presented in this document.

Community Acceptance

The community expressed a very strong acceptance of the selected remedy at a Public Meeting held on August 9, 1989. The comments received during the public comment period which are summarized in the Responsiveness Summary section also show that the public is very pleased with the selected remedy.

Table 2. Summary of Costs* for Detailed Remedial Alternatives

	Area of Site								
Remedial Alternative	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	GW Coll.	GW Treat.
No Action	$ 388**								
Passive GW Collection								$ 173	
Passive GW Treatment									$ 431
Active GW Treatment									$5,560
Clay Capping	$ 533		$399						
Impermeable Capping	$ 558	$2,017	$552	$ 444	$1,674		$ 389		
Above-Grade Wet Neut.	$12,567								
Neutralization/Capping	$ 1,281								
Dissolution/Treatment	$ 3,962								
Drainage Control/ Revegetation		$ 147	$106	$ 202	$ 874		$ 175		
On site Landfill				$1,493			$1,246		
Above-Grade Dry Neut.				$ 721	$5,078		$ 303		

* All costs are in $1,000's and include 30 year present worth of O & M.
** Cost for No Action includes all areas of the site, not just Area 1.

SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed analysis of the alternatives, and public comments, both EPA and the Commonwealth of Virginia have determined that the following combination of alternatives is the most appropriate remedy for cleaning up the site:

TREATMENT COMPONENT		ESTIMATED COST
Groundwater:		
Collection:	Passive Collection System (GW-2)	173,000
Treatment:	Passive Treatment System (WT-2)	431,000
Area 1:	In-situ Dissolution and Treatment (A1-10)	3,962,000
Area 2:	Surface Repair of Unvegetated Areas (A2-4)	147,000
Area 3:	Improve Surface Drainage (A3-3)	106,000
Area 4:	Drainage Control and Revegetation (A4-4)	202,000
Area 5:	Drainage Control and Revegetation (A5-4)	874,000
Area 6:	No Action (A6-1)	0
Area 7:	Above-grade Dry Neutralization (A7-7) (in combination with wetland)	0
	TOTAL	5,895,000

The selected remedy consists of dissolution and treatment of copperas waste in Area 1. Drainage controls and revegetation would be implemented in Areas 2, 3, 4 and 5. Area 6 requires no remedial action. Acidified soil in Area 7 would be mixed with lime to neutralize any leachate. Groundwater would be collected by using subsurface drains and trenches with treatment in a constructed wetland. The wetland treatment would be supplemented with active treatment processes necessary to meet set discharge requirements.

Some changes may be made to the selected remedy as a result of the remedial design and construction processes.

Remediation Goals

The purpose of this response action is to control risks posed by acidic discharge into groundwater and the Piney River. By eliminating most of the sources of acidic discharge into the river, the remedial action will prevent future fish kills and stop further leaching of metals and continued degradation of the Piney River. This remedy will address all the six areas of the site that have been

found to be the sources of contamination.

Since no Federal or State ARARs exist for soils, the action level for the in-situ dissolution and leachate collection remedy for Area 1 would be determined using fate and transport modeling to determine the level to which acidic producing potential of the soil should be reduced in order to ensure that the leaching of contaminants to groundwater and surface water above levels protective of the Piney River as determined by the SWCB would not continue. At a minimum, the leaching shall not cause the Piney River to exceed State Water Quality Standards.

The termination of in-situ dissolution and leachate collection would be determined using the results of soil boring tests, and fate and transport modeling to estimate the potential of groundwater contamination that could result from the migration of residual contaminants in the soil. The leaching process shall be stopped when (1) soil boring tests show that no significant amount of copperas remains in the pits, and (2) the residual acidity in the formation is such that if leached into groundwater and discharged into the Piney River would not violate the ARARs for the river.

Discharge from Area 1 into the wetland would only be allowed when the water to be discharged is comparable to the quality of influent water into the wetland and provided such additional discharge capacity would not adversely affect the performance of the wetland. In any case, no discharge would be allowed until the dissolution process is near completion. Any discharge into the Piney River must meet the discharge limits set forth in Appendix I.

All solid wastes generated during the remediation process would be subjected to EP Tox testing and then disposed of according to VHWMR and RCRA-LDRs (Federal) or the VSWMR.

STATUTORY DETERMINATIONS

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that when complete, the selected remedial action for this site must comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws unless a statutory waiver is justified. The selected remedy also must be cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

Protection of Human Health and the Environment

The selected remedy protects human health and the environment through treatment of the copperas waste in Area 1, the area of the site contributing the greatest percentage of contamination to groundwater; stabilization of other areas by implementing drainage controls and establishing vegetative covers; and collection and treatment of contaminated groundwater. These measures would reduce the amount of contamination reaching the Piney River and eliminate erosion of acidic material by surface water run-off from the site.

All solid residuals and wastes that result from the implementation of the selected remedy would be property classified and disposed of and would not pose any environmental or health hazard. There are no short-term threats associated with the selected remedy that cannot be readily controlled. In addition, no adverse cross-media impacts are expected from the remedy.

Compliance With Applicable or Relevant and Appropriate Requirements

The selected remedy will comply with all applicable or relevant and appropriate chemical-, action-, and location-specific requirements (ARARs). All RCRA authority has been delegated to the Commonwealth of Virginia except those under the 1984 Hazardous and Solid Waste Amendments(HSWA). The ARARs are presented below. Monitoring of the effluent from the groundwater treatment system will be required to assure compliance with the discharge limits established by the VWCB. All alternatives would be implemented and maintained until surface water standards are achieved in the Piney River, and toxicity to the aquatic community in the Piney River is eliminated.

Action-specific ARARs:

Implementation of the selected remedy will involve the discharge of treated effluent into the Piney River. Section 402 of the Federal Water Pollution Control Act requires that a point source discharge of pollutants into surface water be done pursuant to a National Pollution Discharge Elimination System (NPDES). The NPDES system in Virginia is administered by the VWCB under its Permit Regulation VR-680-14-01. Effluent limitations and other discharge requirements have been developed by the VWCB and are presented in Appendix I.

The site was associated with mining operations in the past. Virginia Department of Mines, Mineral and Energy regulations contain closure requirements for surface mining of minerals other than coal.

The selected remedy would require soil excavations particularly during the construction of the wetland. Soil & Sediment Erosion Control of Nelson County, Virginia, and the Virginia Department of Conservation and Historic Resources, Division of Soil and Water Conservation require erosion control plans for excavations and earth moving of areas greater than 10,000 square feet.

Chemical-specific ARARs:

The chemical-specific ARARs for the selected remedy have been provided by the VWCB and are presented in Appendix I. These satisfy the Federal Water Pollution Control Act (Section 33 U.S.C, 1251 et seq.) and the Virginia State Water Control Law (Section 62.1-44.14(3) of the Code of Virginia).

Location-specific ARARs:

Location-specific ARARs include Executive Order 11988 (40 CFR 6, Appendix A - Protection of Floodplains). Areas 5 and 7 lie within a 100-year floodplain.

Land Disposal Restriction

The Land Disposal Restrictions (LDRs) of the Hazardous and Solid Waste Amendments (HSWA) to RCRA place restrictions on the land disposal of RCRA hazardous wastes. At present there are no RCRA Subtitle C wastes at the site and as such the restrictions do not apply. However, should any of the wastes resulting from the remedial action be classified as a RCRA Subtitle C waste, the LDRs would become applicable. LDRs also prohibit the use of any waste or sludge from the treatment process as a backfilling material.

Other Criteria, Advisories or Guidance To Be Considered for This Remedial Action (TBCs)

Local deed restriction to prohibit excavation at any of the contaminated areas of the site and the wetland to be constructed even after the remedial action is complete unless all residual contamination is known to have been eliminated.

OSHA requirements that regulate worker safety and employee records during all site work (OSHA of 1970, 29 U.S.C. 651).

All pollutants remaining on site would comply with all ARARs as required by CERCLA Section 121(d)(2)(A)(i) and (ii).

Cost- Effectiveness

The selected remedy is cost-effective because it has been determined to provide overall effectiveness proportional to its cost, the net present worth being $5,895,000. The estimated cost of the selected remedy is less than twice the cost associated with neutralization and capping the waste in Area 1 ($3,214,000), and yet the selected remedy assures a much higher degree of permanence and long-term effectiveness since the major source of contamination at the site would be permanently destroyed. The current cap on the waste has failed in many areas and re-capping the waste would

not provide a permanent solution. The selected remedy will effectively reduce the current hazards posed by the site by significantly reducing acidic and toxic metal discharges into the Piney River.

Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

EPA and the Commonwealth of Virginia have determined that the selected remedy represents that maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the final source control at the site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA and the Commonwealth of Virginia have determined that the selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, cost, also considering the statutory preference for treatment as a principal element and considering State and community acceptance.

The selected remedy will significantly reduce the inherent hazards posed by the presence of acidic producing wastes at the site and thus offer a high degree of long-term effectiveness and permanence for the site. The selection of a treatment option for the waste in Area 1 is consistent with program expectations which indicate that priority consideration for treatment of highly mobile wastes is often necessary to ensure the long-term effectiveness of a remedy. The selected remedy has therefore been determined to be the most appropriate solution for the U.S. Titanium site.

Preference for Treatment as a Principal Element

By treating the waste in Area 1, the selected remedy addresses a principal source of threat posed by the site through the use of treatment technologies. Therefore, the statutory preference for remedies that employ treatment as a principal element is satisfied.

APPENDIX I

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

Effluent limits for discharge from the groundwater treatment system into the Piney River are required at this time for pH and Total Iron for which substantial effluent data exist. Iron is a principal contaminant of the wastewater and must be controlled in order to meet water quality standards, reduce the toxicity impact of the discharge, and minimize the solubility of any toxic metals present in the discharge.

In addition, a Toxic Management Program (TMP) incorporating effluent biological toxicity monitoring, effluent chemical monitoring for selected priority pollutant metals, and benthic surveys in the Piney River shall be maintained.

The required limits for discharge and TMP are as follows:

Total Iron

The effluent limit for total iron is 97,583 micrograms per liter (10.7 kg/day, monthly average and 21.4 kg/day, daily maximum). This is based on a design flow of 0.0288 million gallons per day. Monitoring shall be conducted twice a month, Grab.

pH

The effluent limit for pH is 6.0 to 9.0. The discharge shall be monitored once a day, Grab. (A reduction in the monitoring frequency will be considered after sufficient data have been collected and evaluated by the VWCB) The effluent limit is equal to the pH range specified in the Water Quality Standards (WQS) for Piney River. Control of pH is crucial to assuring maintenance of the WQS in the receiving stream which has essentially no buffering capacity. Maintaining effluent pH in the proposed range will also reduce the solubility of any toxic metals present in the discharge and the toxic impact on the receiving stream.

Chemical Oxygen Demand

No effluent limit is proposed for Chemical Oxygen Demand (COD) but monitoring shall be conducted twice a month, Grab, in order to determine whether the discharge of reduced species, e.g., ferrous iron, may be exerting an immediate oxygen demand in the river. Should evidence of a significant oxygen demand in the discharge be indicated, additional effluent limitations would be imposed to maintain WQS.

Toxic Management Program

The key elements of the Toxic Management Program (TMP) for the U.S. Titanium site are as follows:

- Semiannual acute toxicity tests on stormwater runoff discharge for a period of two years using Daphnia pulex and Pimephales promelas.

– Quarterly acute toxicity tests on the wetlands treatment system effluent for a period of one year using Daphnia pulex and Pimephales promelas.

– Semiannual priority pollutant metals analyses in conjunction with semiannual toxicity testing and quarterly priority pollutant metals analyses in conjunction with quarterly toxicity testing.

– An initial priority pollutant and non-priority pollutant extractable and volatile organics chemical analysis of the wetlands treatment system effluent concurrent with the first acute toxicity test.

– Semiannual benthic macroinvertebrate surveys in the Piney River shall include the same stations as have been used in the surveys previously conducted by the State Water Control Board. Copies of these surreys may be obtained upon request.

The following presents the details of the Toxic Management Program.

1. Biological Monitoring:

a. Commencing within three months of the effective date of the wetlands treatment system operation, quarterly acute toxicity tests shall be conducted for a period of one year on 24-hour composite samples of effluent from the wetlands outfall and conduct semiannual acute toxicity tests for a period of two years on grab samples of stormwater runoff from the site. The acute tests shall be 48-hour static tests using Daphnia pulex and 96-hour static tests using Pimephales promelas, both conducted in such a manner and at sufficient dilutions for calculation of a valid LC50. Technical assistance in developing the procedures for theses tests shall be provided by the State Water Control Board staff, if requested by the discharger. Test protocols and the use of alternative species shall be approved by the State Water Control Board staff prior to initiation of testing.

b. If the LC50 is greater than or equal to 100% effluent in 6 or more of the total of 8 acute toxicity tests conducted on the wetlands effluent, the operator shall continue acute toxicity testing of wetlands effluent annually. The first annual tests shall be conducted within three months of the last quarterly tests. The test organisms shall be those identified as the most sensitive species from the quarterly acute tests or alternative species approved by the State Water Control Board staff.

c. If the LC50 is greater than or equal to 100% effluent in 6 or more of the total of 8 acute toxicity tests conducted on the stormwater runoff, the runoff shall be considered to be uncontaminated an no further testing shall be required.

d. If the LC50 is less than 100% effluent in 3 or more out of the total of 8 acute toxicity tests for either effluent, a toxicity reduction evaluation will be required for that effluent.

e. If, in the testing according to (b) above, any of the annual acute toxicity tests yields an LC50 of less than 100% effluent, the test shall be repeated within 3 months. If the retest also indicates an LC50 of less than 100% effluent, quarterly toxicity testing as in (a) above shall commence within three months. The results of these tests will be included in the evaluation of the need for toxicity reduction. If the retest does not confirm the results of the first test, then annual testing shall resume.

2. Chemical Monitoring:

a. Within three months of the effective date of the wetlands treatment system operation, the operator shall collect one 24-hour composite sample of the effluent from the wetlands treatment system outfall, except in the cases of volatile organics, phenols and cyanide analyses, where grab samples are required. These samples shall be analyzed for the following:

(1) Priority pollutant and non-priority pollutant extractable and volatile organics using EPA's gas chromatography-mass spectrometry methods 624 and 625, or other equivalent EPA approved methods. The operator shall report all priority pollutant organics present at the method detection limits established in methods 624 and 625. In addition, for each sample, the operator shall tentatively identify a maximum of thirty organic substances which are detected but are not listed as priority pollutants. All of the non-priority substances of greatest apparent concentration for each volatile fraction, to a maximum of 10, and all of the non-priority substances of greatest apparent concentration for the combined base/neutral/acid fraction, to a maximum of 20, shall be tentatively identified.

(2)

Pollutant	Minimum Detection limit (mg/l
Total phenols	0.010
Total cyanide	0.020

b. Within three months of the effective date of the wetlands treatment system operation and continuing quarterly for a period of one year, the operator shall collect 24-hour composite samples of the effluent from the wetlands treatment system outfall.

c. Within three months of the effective date of the wetlands treatment system operation and continuing semiannually for a period a two years, the operator shall collect grab samples of the effluent from the stormwater discharge outfall.

d. The samples collected in (2.b.) and (2.c.) shall be analyzed for the following pollutants:

Pollutant	Minimum Detection limit (mg/l
Total recoverable antimony	0.010
Total recoverable aluminum	0.010
Total recoverable arsenic	0.010
Total recoverable beryllium	0.010
Total recoverable cadmium	0.001
Total recoverable hexavalent chromium	0.010
Total recoverable chromium	0.010
Total recoverable cobalt	0.010
Total recoverable copper	0.001
Total recoverable lead	0.001
Total recoverable manganese	0.010
Total recoverable mercury	0.0002
Total recoverable nickel	0.010
Total recoverable selenium	0.010
Total recoverable silver	0.0002
Total recoverable thallium	0.010
Total recoverable zinc	0.010

e. The chemical analyses in (2.d.) shall be conducted using EPA approved methods. The operator shall obtain approval from the State Water Control Board staff before using non-EPA approved test methods, or detection limits at other than those required in this special condition.

f. The sampling requirements in (2.b.) and (2.c.) shall be conducted in conjunction with the biological monitoring required in (1) whenever possible. When the results of biological testing of the wetlands treatment system effluent indicate the necessity for resuming quarterly toxicity testing, the quarterly sampling and chemical analyses described in (2.b.) and (2.d.), respectively, shall also resume.

3. Benthic Macroinvertebrate Survey:

a. The operator shall conduct semiannual macroinvertebrate surveys of the Piney River during April and September for the first three years of the wetlands treatment system operation. The survey protocol shall be designed in accordance with EPA publication EPA-670/4/73-001, July 1973, “Biological Field and Laboratory Methods for Measuring the Quality of Surface Waters and Effluents,” Technical assistance in developing the procedures for this survey shall be provided by the State Water Control Board staff, if requested by the discharger. Survey protocols shall be approved by the State Water Control Board staff prior to initiation of the survey.

b. The macroinvertebrate surveys shall include the same stations as have been used in the surveys previously conducted by the State Water Control Board. Copies of these surveys may be obtained upon request.

c. Data required in the survey shall include station number, station location, dissolved oxygen, pH, temperature, habitat description, organism identification, number of organisms, diversity calculations, and appropriate comments.

4. Toxicity Reduction Evaluation:

a. If the results of this Toxic Management Program or other available information indicate that the wastewaters are discharged in toxic amounts, the operator shall submit a toxicity control plan and an accompanying implementation schedule within 120 days of the notification of such a determination by the State Water Control Board. This plan shall be designed to evaluate effluent toxicity and assure that no toxic substances are released into State waters in concentrations that will affect survival, growth or reproduction of any species which would reasonably inhabit those waters.

b. The control plan shall include an evaluation of appropriate measures, both immediate and long range, such as additional waste treatment or changes in the operation of the facility, to reduce the toxicity of the wastewater discharge to acceptable levels.

MONITORING SCHEDULE

Medium	Locations	Parameters	Frequency
Groundwater	Wells 1,2, 5, 6, 7, 8, EPA-1, EPA-2, EPA-3, EPA-4, EPA-5, 501, 5-5, 5-8, 5-9	pH, conductivity, sulfate tot. diss Fe, acidity GW elevation	1/Qtr. for 2 years[1]
Groundwater	Same as above	As, Ba, Cd, Cr, Cu, CN, Pb, Hg, Se, Ag, Zn[2]	2/Yr. for 2 years[3]
Surface Water	Piney River Sta. 1, 3, 5, 6	pH, conductivity, sulfate, tot. diss. Fe, acidity	1/Mo. for years[1]
Surface Runoff	Sta. 7, 8	See effluent limitations and monitoring requirements provided earlier in this Appendix.	
Wetland Treatment System	Influent & Effluent	See effluent limitations and monitoring requirements provided earlier in this Appendix.	
Soils	Areas 1, 2, 3, 4, 5, 7	Sufficient to determine fertilizer & lime requirements	1/Yr.

Notes:

1. A request for reduction in frequency will be considered after 2 years of data have been evaluated.

2. This list of parameters may have to be revised pending resolution of the question raised earlier regarding the GWQS as ARAR's.

3. A request for reduction in frequency and number of parameters will be considered after 2 years of data have been evaluated.

INSPECTION AND MAINTENANCE SCHEDULE

Area	Frequency
Groundwater Collection System	Inspect once/qtr. for 1st yr.; 2/yr thereafter. Perform maintenance as indicated by inspections.
Groundwater Treatment System	Inspect at least as frequently as monitoring is performed. Perform maintenance as indicated by inspections.
Area 1	If Alt. Al-8 is implemented this is N/A, although monitoring and other requirements will be required for the treatment facilities.
Area 2	Inspect 2/yr. Performance maintenance as indicated by inspections.
Area 3	Inspect 2/yr. Performance maintenance as indicated by inspections.
Area 4	Inspect 2/yr. Performance maintenance as indicated by inspections.
Area 5	If Alt. A5-4 is implemented, inspect one/qtr. for 1st yr.; 2/yr. thereafter. Perform maintenance as indicated by inspections.
Area 6	None
Area 7	Inspect 2/yr. Perform maintenance as indicated by inspections. Applicable to part of Area 7 not included in wetland treatment system.
Monitoring Wells	Make an initial evaluation of structural integrity and capability of providing representative samples. Inspect for same thereafter in conjunction with groundwater monitoring.

APPENDIX II:

DESCRIPTION OF EVALUATION CRITERIA

Overall Protection of Human Health and the Environment - addresses whether or not a remedy will: cleanup a site to within the risk range; result in any unacceptable impacts; control the inherent hazards (e.g, toxicity and mobility) associated with a site; and minimize the short-term impacts associated with cleaning up the site.

Compliance with ARARs - addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of other environmental statutes and/or provide grounds for invoking a waiver.

Long-term Effectiveness and Permanence - refers to the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

Reduction of Toxicity, Mobility, or Volume through Treatment - refers to the anticipated performance of the treatment technologies that may be employed in a remedy.

Short-term Effectiveness - refers to the period of time needed to achieve protection, and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

Implementability - describes the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the chosen solution.

Cost - includes the capital for materials, equipment, etc, and the operation and maintenance costs.

Support Agency Acceptance - indicates whether, based on its review of the SRI, FS, and Proposed Plan, EPA concurs with, opposes, or has no comment on the preferred alternative.

Community Acceptance - is assessed here in the Record of Decision following a review of the public comments received on the SRI, FS, and the Proposed Plan.

PART C

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

I. OVERVIEW

A public meeting was held in Lovingston, Virginia on August 9,1989 to discuss the Proposed Plan for Cleanup at the U.S. Titanium Superfund site in Piney River. The public comment period for written and oral comments on the Proposed Plan extended from July 31 through September 29, due to a request granted by the Virginia Department of Waste Management to extend the comment period by 30 days.

The Preferred Alternative specified by the Department of Waste Management at the public meeting, and throughout the comment period, addresses both groundwater and soil contamination at the site. The Preferred Alternative involves in-situ dissolution of the copperas/soil mixture in Area 1, the copperas landfill; above-grade dry neutralization of acidic soils in Area 7; and surface repair and/or revegetation throughout the other areas identified on site as needing remediation. Groundwater would be collected through a series of subsurface drains and trenches, and channeled to a wetlands treatment system on-site.

Judging from comments received during the public meeting and throughout the public comment period, the residents and Nelson County Administration strongly support the remedy proposed by the Department of Waste Management. The interested community, composed largely of members of the local Blue Ridge Sierra Club, adamantly expressed their desire for a long-term, treatment technology to be used in remediating acidity at the site. A very small minority of community residents, composed mainly of former American Cyanamid employees, as well as the PRP itself, object to the long-term treatment technology proposed by the State. The PRP, American Cyanamid, favors a clay cap for Area 1. The small contingent of residents that oppose long-term treatment favor either the clay cap proposed by the PRP, or do not feel any action is necessary at all. The vast majority of the community and community officials oppose capping due to the failure of the cap placed on Area 1 in 1980, and a general preference for permanent treatment.

The following sections comprise this Responsiveness Summary:

- Overview
- Background on Community Involvement
- Summary of Comments Received During Public Comment Period and the Department's Responses
- Appendix A: Community Relations Activities Conducted at the U.S. Titanium site community
- Appendix B: Supplemental Information
- Appendix C: Citizen letters submitted to VDWM
- Appendix D: Glossary of Superfund Terms
- Appendix E: Index of Documents for the Administrative Record File

II. BACKGROUND ON COMMUNITY INVOLVEMENT

While the U.S. Titanium site is located in a predominantly rural area, there has been considerable interest among residents since the late 1970's fish kills. The local Blue Ridge Chapter of the Sierra Club was formed after the fish kills to monitor site-related activities. Many of the membership live along the Piney or Tye Rivers, and strongly support the use of the rivers for recreational activities and tourism lures. Since American Cyanamid was once the major employer in the area, there are several former employees that support the remedial option suggested by American Cyanamid.

In 1980, a local attorney took action representing several people who resided along the Piney and Tye Rivers. This attorney actively solicited information from the State Water Control Board and the State Department of Health, Division of Hazardous Waste Management. All in all, correspondence indicates that there was considerable concern about the impacts of the contaminants of river life, and a good degree of interest in the remediation of the site. This group closely followed activities leading to the installation of the clay cap over Area 1, the copperas burial pit, and hired their own environmental engineering consultant to review the option. They expressed concern that the project must be carried out according to the specifications if it were to be successful. The correspondence also indicated that the attorney representing residents did not feel that the Agencies' response to information requests was adequate at that time.

Many of the same residents that were interested in site remediation early in the process continue to be very active now. The same concerns surfaced at the public workshop, meeting, and during the comment period, by and large, that surfaced in the beginning of the process. Upon receiving information on the process and the technologies proposed, the public responded with interest and asked in-depth questions. The local media have followed site activities consistently.

Activities sponsored by the Virginia Department of Waste Management have gotten good response, and workshops and public meetings have drawn between 25 and 75 people. A list of community relations activities can be found in the Appendix A.

III. SUMMARY OF COMMENTS AND RESPONSES

The attendance at the public meeting was approximately 75 people, including residents, local government officials, State representatives, EPA representatives, American Cyanamid representatives, and media. The meeting lasted 4 and a half hours, and there was considerable interest exhibited by the public. Other than at the meeting, very few comments arrived by mail or by telephone. All of these comments are summarized and responded to in this document.

The primary concerns held by citizens and local officials involve the following:

- Adverse impact of the site contamination on the future economic development of the County, and on recreational use of the rivers.
- Acidic seepage leaching metals from the soil into the groundwater, and into the Piney River.
- Monitoring the groundwater and surface water for acidity and heavy metals.

- ♦ The integrity of a contractor that is selected by PRP to do RD/RA work.
- ♦ The availability of ongoing public participation opportunities.
- ♦ The implementation of a permanent, treatment-oriented cleanup plan.

Strong support has been voiced for the Proposed Plant issued by the State, with the concurrence of EPA, due to its permanent, treatment-oriented direction. The people of the community, who have been very active throughout site remediation history, voiced a desire to have the problem eliminated "once and for all". There is strong support from the public for extensive monitoring, including residential wells and the Piney and Tye Rivers, to ensure the effectiveness of the treatment systems. There is also concern about heavy metals from the soil leaching into ground and surface water with the acidic runoff. The public at large also showed a good deal of concern about the PRP selection of the contractor to do the work, and urged the State and EPA to screen and monitor the choice very closely to ascertain that the job is done correctly. The public wants to continue being included in the information circle with regards to these activities.

The majority of commentors adamantly opposed the plan set forth by Hydrosystems, on behalf of American Cyanamid, one of the PRPs, to cap the copperas burial pit that is Area 1. Opposition to the capping proposal stems from the failure of the cap installed in 1980 and the resultant environmental problems, and the desire for a permanent solution.

A representative for the PRP stressed that American Cyanamid was only one of a number of Potentially Responsible Parties, and was so far the only PRP that was willing to step forward and take part in the remedial process for this site. The State concurs with this fact.

The general areas of comment and concern, with responses, follows. Supplemental information for some of the comments can be found in Appendix B, and letters forwarded by citizens are compiled in Appendix C.

III.A. General Comments

Comment: Mr. Stephen Lamanna, a local citizen, wrote two letters to the department saying that the buried material at the Piney River site now is essentially water insoluble residues. Mr. Lamanna holds that "there is no problem, and there no chance that a fish kill can occur because there isn't enough ferrous sulfate in the entire area." Mr. Lamanna also referred to his own "pH tests" of the Piney River which, he said, indicated that the pH levels are fine.

Response: Testing by the State and EPA has shown residual acidity at the site that continues to pose a hazard to the water and surrounding environment. Testing by Hydrosystems on behalf of American Cyanamid showed a drop in pH levels in 5 of 180 samples. In these tests, low pH levels occurred after heavy rains. Several citizens also cited that testing may have been done during the drought conditions that were predominant during the RI/FS.

Response: Dr. John T. Novak, Virginia Polytechnic Institute and State University School of Engineering, after receiving a copy of Mr. Lamanna's letters, wrote that testing has indeed indicated that there is a problem at the Piney River site, and that Mr. Lamanna's information was erroneous.

Comment: One resident wanted to know what the Hazard Ranking System score for the Piney River site was.

Response: The HRS score for the U.S. Titanium site at Piney River was 34.8, done in 12/82.

Comment: One resident asked what the pH levels were of the seepage, groundwater, and surface water.

Response: pH testing at the site revealed the following ranges: groundwater: 3-6; seepage/leachate: 2-4; runoff: 5-6; and river: 5-7.

Comment: A large group of residents, including some local officials, supported the following comment: "The evidence is clear that there is a problem here, just analyze it as if you lived downstream from the Piney River...Folks around here on the Piney and Tye Rivers don't want the Piney River turning into lemonade...use that sort criteria when you determine what is the best solution."

Response: The recommendation set forth by the State, with the concurrence of EPA, takes into account the concerns of the citizens regarding the economic future of the area, and the many uses of the river for recreation, fishing, and nature watching. With these criteria in mind, the State and EPA propose a permanent, treatment-oriented solution.

III.B. Comments on the Proposed Plan

Comment: The Blue Ridge Sierra Club "generally favors" the State/EPA proposed alternatives over the recommendations Hydrosystems, Inc. on behalf of American Cyanamid. The Club "strongly supports the intent of CERCLA and the NCP in choosing remedial actions which are permanent and which prevent or minimize the release of hazardous substances to the environment (and) also realizes that the remedial action chosen must be practicable and cost effective."

Comment: There is widespread concern about the monitoring of residential drinking water wells along the Piney and Tye Rivers, as well as testing the various waters for the heavy metal content which results from acidic leachate trickling through the soils.

Response: By neutralizing the acidity in Area 1, the leaching of heavy metals into the groundwater will be greatly reduced to naturally occurring levels. In addition, testing will be done on all water prior to discharge to meet water quality standards. The frequency and type of groundwater, surface water, and river and residential well water monitoring will be determined during the Remedial Design activity. The State will also review the possibility and interest for a public workshop to review and discuss the Remedial Design Study prior to the initiation of the Remedial Action stage.

Comment: There is also considerable concern the, during In-Situ Dissolution in Area 1, the soil under the pit may allow leaching of the dissolved solution into the groundwater. Citizens questioned whether enough hydrogeology has been done under the pit to ensure that groundwater will not be contaminated.

Response: Hydrogeological studies will be performed during the Remedial Design stage, prior to implementation of the cleanup plan. In addition, all groundwater in this area will be rerouted through a series of subsurface drains and trenches and treated in the groundwater treatment system.

Comment: One resident asked whether adding a synthetic liner in area 3 would keep contaminants from leaching, and what the cost of such a liner would be.

Response: The cost of a synthetic liner in Area 3 would be an estimated $552,000. The State rejects the idea of placing a liner in Area 3 because it would interfere with the effectiveness of the groundwater collection and treatment system.

Comment: Residents were interested in knowing where the Proposed options have been utilized.

Response: In-situ Dissolution of leachate, as well as revegetation and groundwater collection and treatment, have been studied in-depth by the U.S. Bureau of Mines. In addition, these remedial technologies have been used Colorado; Alabama, Pennsylvania, Tennessee, and West Virginia, and in many acid mine drainage reclamation programs.

Comment: Several residents asked what chemicals, if necessary, would be used in the In-Situ Dissolution process and the wetlands treatment system; and what will the byproducts of neutralization be.

Response: Limestone will be used to achieve the proper pH, or neutralize the acidity in the soils and water. The byproduct of neutralization is water.

Comment: Two residents questioned whether there would be a lot of land moving, and who would do this work.

Response: The amount of land moving in the remedial action proposed by the State and EPA would be minimal. Any work that is required for the remedial action, provided that the site remains an enforcement-lead site, will be done by contractors hired by the PRPs. The State and EPA will supervise efficiency, effectiveness, and compliance with regulations and the Record of Decision (ROD).

Comment: A representative of Hydrosystems, Inc. indicated that the proposed alternatives supported by the State and EPA at the public meeting were not the alternatives that Hydrosystems "selected" during the feasibility study and that "they have been, in some cases, upgraded slightly to more extensive alternatives." The representative of Hydrosystems, Inc, commented that, for Areas 3, 4, and 6, where the State and EPA proposed revegetation, Hydrosystems proposed no action because vegetation has come in naturally.

Response: This is correct. The State and EPA selected its Preferred Alternatives because, after a review of all recommendations set forth in the feasibility study, and a review of the problems at the site, the agencies felt that a more extensive and permanent response was needed to best meet the nine evaluation criteria set forth in Superfund. Revegetation of these areas will be reviewed on a case by case basis. Where areas have a thick vegetative cover, and are not required for use during remedial action, the existing vegetative covers will be left as is.

Comment: The representative of Hydrosystems, Inc. indicated that the firm monitored the river over a period of several months, did over 180 pH measurements, and only on five occasions did the river drop below a pH of six (6), and this was during storm events.

Response: The plan proposed by the State and EPA will help to avoid such fluctuations in the pH level a ground and surface water during storm events (heavy rains and snow), or periods

of drought, when groundwater discharge could have a greater effect on the Piney River.

Comments: The following comment was set forth by a representative of Hydrosystems, Inc., during the public meeting, 8/9: "One of the important points that has never been brought up here is that there are no hazardous wastes on the site. Ferrous Sulfate is no hazardous waste. The pH of the material, of the water coming off the site, is no higher than that of lemon juice...We're not dealing with something that if you jump into it, you are going to dissolve, it's just not going to foam away, it is no more acidic than lemon juice."

Citizen Response: The response of the citizens to this particular comment was widespread and strong. One resident, with considerable applause by other residents, contributed the following: "The fact that there is no hazardous waste on that site is an insult to our intelligence. It is very important to the economic development of Nelson County that we rid ourselves of this blight. Also, we may want to use the river or groundwater for a public water system, which this county desperately needs."

State Response: It is true that copperas is not a problem by itself, but when interacted with water and oxygen, it produces an acidic solution, sulfuric acid. That acid, when leaching through the soil, releases metals from the soil that are added to the groundwater and surface water. For these reasons, a more permanent, treatment-oriented technology is recommended by the State and EPA.

Comment: Several inquiries were made into the production of sludge during In-Situ Dissolution, what the volume will be, will it be toxic, and what will be done with it.

Response: The sludge, or filter cake, resulting from the process of In-Situ Dissolution in Area 1 is not expected to be acidic or toxic. The substance will, however, be tested to ascertain that it is of a composition that can be disposed of as a non-hazardous waste. If the substance has residual toxicity, it will be transported and disposed of or treated at a RCRA-permitted facility. Specific information on the exact volume or composition will be determined during Remedial Design and Remedial Action. It is unlikely that the material produced will be more toxic than it currently is because, broken down, we will still be dealing with iron and sulfur.

Comment: Was there any consideration given to an impermeable cap in Area 1?

Response: Yes, the State and EPA considered impermeable capping among the alternatives reviewed, but prefer a more permanent, treatment-oriented remedy, as all capping has a lifespan limit and the waste still exists.

Comment: One resident questioned whether any attempt was made to see if there is any migration of copperas-laden or acidic water off the Piney River site.

Response: The pathways of migration were reviewed to determine if and where contaminants were migrating off of the site. In addition, sampling was conducted to determine the specific problem areas and risks of the site.

Comment: One resident asked if the State and EPA plan are the same as the on proposed by Hydrosystems, Inc., only faster.

Response: The plan set forth by the State and EPA has similarities to the plan set forth by Hydrosystems, Inc. on behalf of a PRP, American Cyanamid. However, the State/EPA plan has marked differences in the recommendations for the proper handling of the waste in Area 1, the

copperas burial pit. The State and EPA propose a permanent treatment of the mixture, eliminating the possibility of future contamination occurrences. As compared with the capping option recommended by the PRP, In-Situ Dissolution is a permanent solution, and capping is not. In-Situ Dissolution neutralizes the acidic waste source, while capping places a barrier over the waste.

III.C. Costs, Funding, and Schedule

Comment: The Sierra Club indicated that membership felt that the State/EPA plan better meets Superfund Criteria, and that it is cost effective "especially when viewed in light of the $30-40 million price tag for the average cleanup of an NPL site in the U.S. today."

Comment: One Piney River resident and one Charlottesville resident commented that they did not feel that the taxpayers should have to pay for the cleanup.

Response: The first priority of the Superfund law is to encourage those parties responsible for generating the waste that leads to contamination to pay for and undertake cleanup measures. If no responsible party can be identified, or if the responsible party is not financially capable of undertaking the cleanup in an efficient manner, the site may be cleaned up as a "fund-lead" using the Superfund Trustfund that is made up of taxes on petroleum and chemical companies. The Superfund Trustfund is not generated from a tax increase for individuals at this time.

Comment: Several residents asked about the timeframe for Remedial Design/Remedial Action completion.

Response: Various components of the State plan will take different times to implement. The components, such as revegetation or In-Situ Dissolution, can also be implemented simultaneously. The current timeframe expected for the completion of the most time consuming variables is approximately three years from now. Monitoring will continue beyond that time.

III.D. Public Participation

Comment: The Blue Ridge Sierra Club wanted to know where in the Administrative Record could they find the rationale for the State's proposed plan.

Response: The comparison of options considered by the State and EPA for cleaning up the U.S. Titanium Superfund site can be found in the Proposed Plan document, several copies of which can be found at the Nelson County Memorial Library and County Administration Office Administrative Record Files. The State/EPA proposed alternative was selected as best meeting the nine criteria set forth by Superfund; these criteria are outlined in the Proposed Plan.

Comment: The Potentially Responsible Party currently working with the State and EPA to clean up the site, American Cyanamid, requested an extension of the pubic comment period due to the volume of documents in the Administrative Record File.

Response: The State and EPA granted a 30-day extension, extending the comment period from July 31 though September 29, as a matter of routine procedure.

Comment: There was widespread support for continued communication between the State and the community. Several residents asked about having representation at meetings on the

Remedial Design/Remedial Action activities, and being kept abreast of studies and results.

Response: Public participation is an integral part of the Superfund Process. While Technical Assistance Grants were reviewed with community members, the Sierra Club determined that going through the TAG procedure at this time was not their action of choice. The TAG process does, however, remain open to the community as an option for funding their own technical advisor.

In addition, the State will continue to host meetings with individuals or workshops with the community to provide updates and answer questions. Fact sheets will also be distributed throughout the ROD and Remedial Design/Remedial Action stage. Interested citizens and officials should continue to direct any questions, concerns or suggestions to the community liaison, Jamie Walters, at (804) 225-3268 or at the Department of Waste Management, 101 N. 14th Street, 18th Floor, Richmond, Va. 23219. All information that is not confidential will be added to the Administrative Record Files for review by interested community members.

Comment: One resident asked whether the State and EPA would make the final decision of the cleanup option, release the Record of Decision, and then provide additional time for the citizens to review the options.

Response: The Superfund process includes time for the public to receive, review and comment upon alternatives and arguments considered by the State and EPA prior to selecting a cleanup option. The proposed plan, a summary and comparison of the options considered, is introduced to the public at a public meeting or through the Administrative Record File. At this time, citizens are provided a comment period least 30-days long, to review the State's recommendation. Comments and concerns generated during the comment period are summarized and responded to in a document called the Responsiveness Summary, which is a part of the ROD. Once the ROD is signed and issued, the selection of the cleanup option for the site is final, and no longer subject to negotiation. The next process is the Remedial Design/Remedial Action stage, when the option for cleanup is implemented.

Comment: Several inquiries were made by a gentleman at the public meeting regarding a letter sent to the VDWM by Mr. Stephen Lamanna, and whether that letter would be made public.

Response: Mr Lamanna's letter, as well as other comments received during the public comment period, are summarized and included in this Responsiveness Summary document. The Responsiveness Summary is included, with the Record Decision, in the Administrative Record File for review by any and all members of the public.

III. E. Enforcement and Regulatory Issues

Comment: Mr. Jerome Muys, Esq., on behalf of American Cyanamid, wanted to make sure that the public understood that, while the PRP did make technical arguments with some of the State's proposal for cleanup, the PRP was in no way trying to walk away from the problem. Mr. Muys stressed that American Cyanamid only is only one of several PRPs for this site, and is currently the only PRP that has been willing to participate in the process to clean up the U.S. Titanium site.

Response: There are several Potentially Responsible Parties (PRPs) for the U.S. Titanium site, of which American Cyanamid is the only one currently cooperating with the State and EPA for this cleanup process.

Comment: There is widespread concern in the community about the selection by the PRPs of the contractor to carry out the Remedial Design/Remedial Action work. Many members of the public were concerned that, this being the case, the cleanup will not be carried out with maximum effectiveness and with a “sincere desire” to clean up the site.

Response: There are many safeguards in place to ascertain whether the contractor recommended by the PRP(s) is capable and willing to do the RD/RA according to the ROD and Superfund regulations. While the priority of Superfund is to encourage PRPs to undertake and fund the necessary cleanup, the State and EPA also have oversight over all work conducted. The State and EPA also have the authority to reject the PRPs recommended contractor if there is evidence that the contractor will be unable to perform the necessary work.

Comment: Will there be agency staff on site during the RD/RA activities to ensure that work is being done correctly?

Response: Yes, there will be staff members from the State and EPA on site, but the number of staff and the duration of their on site work will vary per activity. For example, some operations will only require agency personnel on site once a week, while others (such as the work proposed for Area 1) may require a full-time staff member on site regularly for a period of two years. The wetland treatment system, because it is a gradual activity, may only require a monthly on site visit by agency personnel. The size of on site staff, and on site review schedule, will be determined in Remedial Design.

Comment: There was concern among several residents that the differences between the State’s plan and the PRPs plan would lead to a court case, and whether such a court dispute would delay the project.

Response: Once the Record of Decision (ROD) is signed, the selected alternative(s) for cleanup are no longer subject to negotiation. There are negotiations that will occur with all Potentially Responsible Parties (PRPs). The negotiations will determine who will pay for and undertake the Remedial Design/Remedial Action work, not whether it will occur. As with all Superfund negotiations, there is the possibility that no Consent Agreement, or cooperation with PRPs, will be reached. The PRPs have 90-days after the ROD is issued to agree to undertake and finance the cleanup. If they don’t, the site remediation may become a Fund-lead, and RD/RA will be undertaken by the State and EPA. Whenever Superfund monies are spent on Fund-lead projects, the agencies can take the PRP to court and recover the cost of the cleanup.

IV. RESPONSES TO COMMENTS FROM AMERICAN CYANAMID COMPANY ON PROPOSED REMEDIAL ACTION PLAN FOR THE U. S. TITANIUM SITE

Responses to comments from American Cyanamid Company are presented below. The comments as submitted by American Cyanamid are presented in Appendix C:

COMMENT 1:

The Administrative Record does not Support the Selection of a Treatment Alternative for Area 1.

RESPONSE:

The Administrative Record, which includes the Remedial Investigation and Feasibility Study reports and the two Addenda to the Feasibility Study, wholly supports the selection of a treatment alternative for Area 1.

The remedial alternatives examined for Area 1 can be broadly classified into two, containment remedies and permanent (treatment) remedies. Only permanent remedies are appropriate for this area.

A containment remedy was applied in 1980 when the waste was buried in Area 1 and capped. This cap has failed in many areas resulting in acidic leachate that is impacting groundwater and the Piney River, and destroying the vegetation.

The most significant emphasis of the Superfund Amendments and Reauthorization Act (SARA) is on risk reduction through destruction or detoxification of hazardous waste by employing treatment technologies which reduce toxicity, mobility, or volume rather than protection achieved through prevention of exposure to such wastes. Section 121 of CERCLA (Cleanup Standards) states a strong statutory preference for remedies that are highly reliable and provide long-term protection. In addition to the requirement for remedies to be both protective of human health and the environment and be cost-effective, additional remedy selection considerations in Section 121(b) include a preference for remedial actions that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous substances, pollutants, and contaminants as a principal element.

While some limited design data are needed for the selected alternative of in-situ dissolution and treatment, and would be allowed for during the remedial design phase, there is sufficient information available at the present moment to justify the selection of the alternative (see response to comment 4).

COMMENT 2:

Treatment alternatives were not subject to necessary laboratory and field studies.

RESPONSE:

According to EPA's Guidance for Conducting Remedial Investigations and Feasibility Studies (RI/FS) under CERCLA (OSWER Directive 9355.3-01, October 1988), treatability investigations can be done during the RI/FS or may be postponed until the remedial design phase. The decision to conduct treatability studies during the RI/FS or to postpone it until the remedial design phase is made by weighing the cost and time required to complete the investigations against the potential value of the information in resolving uncertainties associated with selection of a remedial action. Such a decision is made on a case by case basis. The desire to want to remove all uncertainties before a remedy is selected has to be balanced with the Superfund program's mandate to perform cleanups within designated schedules.

"The objective of the RI/FS is not the unobtainable goal of removing all uncertainty, but rather to gather information sufficient to support an informed risk management decision regarding which remedy appears to be most appropriate for a given site" (OSWER Directive 9355.3-01, Section 1.1). The information currently available is sufficient to support the recommended remedy for this site. The collection of field and pilot plant data necessary to fully design the selected remedial alternative for the site would be done during the remedial design phase.

COMMENT 3:

The In-situ Dissolution and Treatment of leachate alternative was not subject to the required comparative analysis of alternatives.

RESPONSE:

The comparative analysis undertaken in the RI/FS identified and evaluated the key tradeoffs between clay capping, impermeable capping and above-grade wet neutralization. Above grade wet neutralization was the only alternative of these three that would meet the SARA mandated requirement to select, to the maximum extent practicable, a remedy offering a permanent solution to the cleanup problem (CERCLA, Section 121(b)). Despite the paramount importance of selecting a permanent cleanup remedy, the RI/FS identified the preferred alternative to be clay capping. Cost-effectiveness was identified in the RI/FS as the key tradeoff between clay capping and above-grade wet neutralization. The only factor in which above grade wet neutralization was questioned was implementability. The uncertainties in this case are associated with the details of the treatment methodology and are best resolved dump remedial design.

Following the clay capping recommendation in the RI/FS, in-situ dissolution was identified as a potential remedy and was submitted by Hydrosystems on behalf of American Cyanamid Company as a second addendum to the FS. This second addendum presented the elements needed to do comparative analysis of the in-situ dissolution and treatment alternative. The submission discussed the performance, risk reduction, reliability, implementability, safety, environmental analysis, public health, institutional analysis and cost analysis of the alternative.

A formal comparative analysis between in-situ and clay capping (the remedy recommended in the FS) was not required at this point to identify and evaluate the key tradeoffs between the two alternatives. Clay capping was determined to be deficient in a most crucial factor, that of permanence. In-situ dissolution offered permanence, thereby making it a viable alternative under SARA, and was substantially less expensive than above-grade wet neutralization. It should be pointed out that an analysis of alternatives, including in-situ dissolution and treatment, is presented in the Summary of Comparative Analysis of Alternatives section of the ROD.

COMMENT 4:

The section 121 remedy selecting criteria were misapplied: (1) The proposed remedial alternative for area 1 is not necessary to protect human health and the environment or satisfy ARARs. (2) The proposed remedial alternative for area 1 is not cost-effective (3) The proposed remedial alternative for area 1 is not practicable.

RESPONSE:

(1) The proposed remedial alternative for area 1 is necessary to protect the environment and satisfy ARARs for the site. CERCLA Section 121(b)(1) states that, “remedial actions in which treatment which permanently reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants as a principal element, are to be preferred over remedial actions not involving such treatment”. Again, the in-situ dissolution and treatment alternative will meet all of these requirements by permanently eliminating the copperas waste, while clay capping does not.

The ARARs for the site are not limited to pH and iron concentration but include the following:

Action-specific ARARs:

Implementation of the selected remedy will involve the discharge of treated effluent into the Piney River. Section 402 of the Federal Water Pollution Control Act requires that a point source discharge of pollutants into surface water be done pursuant to a National Pollution Discharge Elimination System (NPDES). The NPDES system in Virginia is administered by the VWCB under its Permit Regulation VR-680-14-01. Effluent limitations and other discharge requirements have been developed by the VWCB and are presented in Appendix I.

The site was associated with mining operations in the past. Virginia Department of Mines, Mineral and Energy regulations contain closure requirements for surface mining of minerals other than coal.

The selected remedy would require soil excavations particularly during the construction of the wetland. Soil & Sediment Erosion Control of Nelson County, Virginia and the Virginia Department of Conservation and Historic Resources, Division of Soil Water Conservation require erosion control plans for excavations and earth moving of areas greater than 10,000 square feet.

Chemical-specific ARARs:

The chemical-specific ARARs for the selected remedy have been provided by the VWCB and are presented in Appendix I. These satisfy the Federal Water Pollution Control Act (Section 33 U.S.C. 1251 et seq.) and the Virginia State Water Control Law (Section 62.1-44.14(3) of the Code of Virginia).

Location-specific ARARs:

Location-specific ARARs include Executive Order 11988 (40 CFR 6, Appendix A - Protection of Floodplains). Areas 5 and 7 lie within a 100-year floodplain.

Land Disposal Restriction:

The Land Disposal Restrictions (LDRs) of the Hazardous and Solid Waste Amendments (HSWA) to RCRA place restrictions on the land disposal of RCRA hazardous wastes. At present there are no RCRA Subtitle C wastes at the site and as such the restrictions do not apply. However, should any of the wastes resulting from the remedial action be classified as a RCRA Subtitle C waste, the LDRs would become applicable. LDRs also prohibit the use of any waste or sludge from the treatment process as a backfilling material.

Other Criteria, Advisories or Guidance To Be Considered for This Remedial Action (TBCs)

Local deed restriction to prohibit excavation at any of the contaminated areas of the site and the wetland to be constructed even after the remedial action is complete unless all residual contamination is known to have been eliminated.

OSHA requirements that regulate worker safety and employee records during all site work (OSHA of 1970, 29 U.S.C. 651).

All pollutants remaining on site would comply with all ARARs as required by CERCLA Section 121(d)(2)(A)(i) and (ii).

(2) The selected remedy for this site is cost-effective because it has been determined to provide overall effectiveness proportional to its cost, the net present worth being $5,895,000. The estimated cost of the selected remedy is less than twice the cost associated with neutralization and capping the waste in Area 1 ($3,214,000), and yet the selected remedy assures a much higher degree of permanence and long-term effectiveness since the major source of contamination at the site would be permanently destroyed. The current cap on the waste has failed in many areas and re-capping the waste would not provide a permanent solution. The selected remedy will effectively reduce the current hazards posed by the site by significantly reducing acidic and toxic metal discharges into the Piney River.

CERCLA places an emphasis on evaluating long-term effectiveness and related considerations for potential remedial actions (CERCLA Section 121 (b)(1)(A)). These statutory considerations include long term maintenance costs and the potential for future remedial action costs if the alternative remedial action in question were to fail (CERCLA Section 121 (b)(1)(E)&(F)).

(3) The selected remedy is very practicable. What needs to be determined is the most efficient way to implement it. This will be adequately addressed during the remedial design phase.

A report submitted by In-Situ Inc. to American Cyanamid enumerated three feasible in-situ leaching techniques that could be explored during the RD/RA phase. These are:

Installation of a network of injection and extraction wells throughout area 1 with spacing based upon the hydraulic properties of the copperas/soil for the introduction of water and extraction (by either pumping or collection by gravity into drainage trenches) of the acidic FE-SO_4 solution

Cyclic saturation and drainage of the area by means of surface trenches dug to progressively deeper depths.

Surface irrigation by sprinklers of area 1 with collection of the solutions by means of drainage trenches or drains. In areas where the cap is an effective barrier to flow, the cap may need to be removed or penetrated.

According to In-Situ Inc., provision could be made to allow recirculation of the leach solution back to the injection wells, irrigation system, or surface trenches prior to final collection. All leach solution distribution and collection systems, other than collection by pumping from recovery wells, would be passive in their method of operation. Each of these in-situ leaching alternatives was further discussed by In-Situ Inc.

On the treatment of the leachate collected from the dissolution process, considerable experience exists in the chemical and mining industry. At a meeting held in Richmond on July 12, 1989, Mr. W. E. Trees of Kemira Inc. disclosed that his company has considerable experience in treating wastewaters containing high concentrations of ferrous iron in a weak sulfuric acid solution. Kemira Inc.'s operates a chemical plant in Savannah, Georgia that utilizes the sulfate process in connection with its titanium dioxide operations.

In a recent letter to American Cyanamid dated September 26, 1989, Mr. Trees explains the Kemira process for treating this type of aqueous waste as follows. "Kemira used a two step process to treat the acidic process wastes. The first step consisted of neutralizing the wastewater with limestone, to a pH in the range of 2 to 3, to precipitate gypsum. The second step involved treating the gypsum slurry with slaked lime and aerating the slurry to oxidize and precipitate ferric hydroxide (or hydrated ferric oxide) and gypsum (calcium sulfate dihydrate) as the pH approaches neutral."

The option of product recovery from the leachate is consistent with the selected permanent remedy of in-situ dissolution and treatment. In this case, the leachate would be treated in a way that would allow for recovery of marketable products.

A remedial action that includes a permanent solution, and that precludes future risk of failure, is clearly superior in meeting the criteria for state and public acceptance. Furthermore, with regard to long term maintenance costs and the potential for future remedial action costs if an alternative action fails, the history of clay capping at the site leads to the conclusion that in-situ dissolution should be considered a preferred alternative over clay capping.

The in-situ dissolution and treatment alternative, when measured against statutory guidelines for selecting a remedial action alternative, proves to be a preferred alternative over the other

alternatives considered. The procedure for evaluating and comparing all identified alternatives was done in accordance with the statutory requirements and EPA guidance. The administrative record adequately supports the selection of the in-situ alternative for Area 1.

COMMENT 5:

Comments on passive groundwater collection and treatment.

RESPONSE:

As presented in the Feasibility Study and the Proposed Remedial Action Plan, the components of the groundwater treatment system would include an oxidation/settling pond, a constructed wetland, and a limestone neutralization bed. The oxidation/settling pond would promote formation of insoluble iron hydroxides and settle out entrained sediments. Wetland vegetation would work in conjunction with anaerobic bacteria to remove iron and sulfur species from the water. The limestone bed would act as a final polishing step for pH adjustment before discharge of the effluent to the Piney River. Any discharge from the entire treatment system has to meet the ARARs for surface water discharge into the Piney River. A violation of ARARs for five years as suggested by American Cyanamid is not acceptable and would not be necessary since the performance of the wetland can be synchronized with the operations of the other two units.

APPENDIX A

Community Relations Activities Conducted with the U.S. Titanium Site Community

COMMUNITY RELATIONS ACTIVITIES
U.S. TITANIUM SITE

The following community relations activities have occurred or have been scheduled to occur in the U.S. Titanium site community during the course of remedial activity.

ACTIVITY	DATE
Site Update Fact Sheet	4/20/89
Community Relations Plan Revised	5/12/89
CR Interviews Conducted: local government and Sierra Club representatives	5/18/89
EPA Briefed by VDWM on Proposed Plan	7/18/89
Proposed Plan Completed	7/31/89
Public Notice of Availability of Proposed Plan, CRP, and Administrative Record File and Public Meeting	7/31/89
Public Notice Distributed to Mailing List	7/31/89
Public Comment Period Commences	7/31/89
Proposed Plan Sierra Club/Public Workshop	7/31/89
Public Meeting on Proposed Plan	8/9/89
Public Comment Period Extended	8/30/89
Public Notice of Comment Period Extension	8/30/89
Public Notice to Mailing List	8/29/89
Public Comment Period Ends	9/29/89
Responsiveness Summary Prepared	10/15/89
Public Notice of ROD Availability	10/15/89
ROD Fact Sheet Distributed to Mailing List	10/20/89
Telephone/Mail/Meeting Communications	Ongoing
CRP Revised for RD/RA	11/01/89
RD/RA Kickoff Activities	11/15/89

Ms. Jamie Walters
Community Relations Coordinator
Department of Waste Management
18th Floor, Monroe Building
101 N. 14th Street
Richmond, Virginia 23219

August 28, 1989

Dear Ms. Walters,

I would like to express my appreciation to you and Dr. Longe for the excellent meeting you conducted on what the State plans to do at the U.S. Titanium Superfund Site in Piney River. Your presentation was very clear and complete. You also did an excellent job of running the meeting and answering the many questions.

I would like to go on record as being very much in favor of the alternative for cleaning up the site as set forth by the Virginia Department of Waste Management and very much opposed to the plan proposed by American Cyanamid. I believe the idea of eliminating the problem once and for all is the right one, particularly as this site has already been "cleaned up" once. In my view a clay cap will never provide a solution to the problem - it will just delay the leakage for some years. Eventually the copperas will leak out and pollute the river once again.

I am especially concerned about the heavy metals which result once the copperas dissolves with water and oxygen and becomes sulphuric acid. This seems to me an equally severe problem. A suggestion was made at the meeting that the test wells on the site be tested several times a year for these metals as well as certain other wells in the immediate vicinity and the results of these tests be released to the public. I think this is an excellent suggestion and I would like to formally request that my well be tested. I live downstream from the plant on the Piney River just before it merges with the Tye.

Finally, I would like to express my concern about the possibility of barrels which are buried on the plant site on the Amherst County side. While I am aware that testing in this area did not result in any evidence of potentially harmful material, this situation may change drastically with any kind of construction in the area which might disturb these barrels. I would hope your office would be able to follow the leads given

First is the question of where in the administrative record do we citizens find the rationale for the EPA plan? We find the backup studies for the American Cyanamid plan, but nothing that says where EPA came up with its preferred alternatives. There is also a concern that no drinking water wells have been monitored off the site of the property and none are scheduled for future monitoring after or during the remedial action.

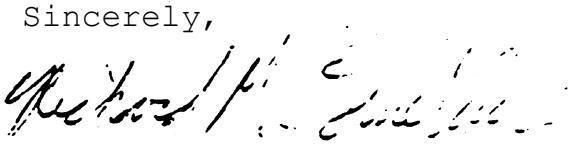
Another major concern of our members is what is going to happen to the runoff collected as a result of the diversion of surface water which is discussed, but for which no treatment if indicated. It seems logical that if one collects runoff from ground which is admittedly acidic that one would treat that water prior to introducing it into the Piney River. This needs to be clarified on the schematic of preferred alternatives handed out at the public meeting.

A further concern over the EPA proposal arises in Area 1. The preferred alternative is to dissolve the Copperas with water, remove the solution and treat it on site. A member of our group is a soils scientist employed by Virginia Tech. He has recently mapped the soils in Nelson County and expresses a concern that the soil under the pit may allow leaching of the dissolved solution into the groundwater. We question whether enough hydrogeology has been done under the pit to assure that groundwater will not be contaminated.

We would like to be assured that this NPL site will never again cause fish kills, stop animals from drinking the water of the Piney River, or cause local citizens to worry about contamination in their wells. To accomplish this we want the EPA/Virginia plan to ensure proper monitoring of groundwater both on and off the sites, and to treat diverted surface water prior to placement in the river.

We believe that the EPA/Virginia proposal is a cost-effective, permanent solution which if properly engineered and monitored will carry out the needs of the community, and the environment, and the requirements of law.

Sincerely,



Richard M. Cornelius
Member of Exec. Comm.
Blue Ridge Sierra Club

BLUE RIDGE GROUP

Department of Waste Management
18th Floor Monroe Bldg.
101 North 14th St.
Richmond, Virginia 23219

ATTN: Ms. Jamie Walters August 25, 1989

Re: U.S. Titanium Superfund Site Public Comment.

Dear Ms. Walters:

This public comment is submitted by the Blue Ridge Group of the Sierra Club, Nelson County, Virginia. The subject of this letter is the EPA preferred alternatives for the clean up of the NPL site known as U.S. Titanium.

Our Blue Ridge Group has been actively involved in this site for the past several years and continues to be very concerned about its proper clean up.

We would like to begin our comment by saying that generally we favor the EPA proposed alternatives over the recommendations of Hydrosystems, Inc., which are made on behalf of American Cyanamid. We strongly support the intent of CERCLA and the NCP in choosing remedial actions which are permanent and which prevent or minimize the release of hazardous substances to the environment. We also recognize that the remedial action chosen must be practicable and cost-effective.

It is our position that the EPA/Virginia proposed alternatives for the seven (7) identified sites meet these stated criteria much more effectively than the proposal set forth by American Cyanamid. The cost of the EPA plan is roughly $5.8 million dollars, the cost of the American Cyanamid plan is $2.3+. For the EPA plan we see a permanent solution to the environmental problems previously caused by these sites next to the Piney River. The same cannot be said for the American Cyanamid capping proposals. The cost is reasonable especially when viewed in light of the $30-40 million dollar price tag for the average clean up of an NPL site in the U.S. today.

Although we strongly support the existing EPA/Virginia preferred alternatives, we would like to raise some questions which are of concern to a number of our members, including people who live near the Piney River, use the river for fishing or just enjoy its natural beauty.

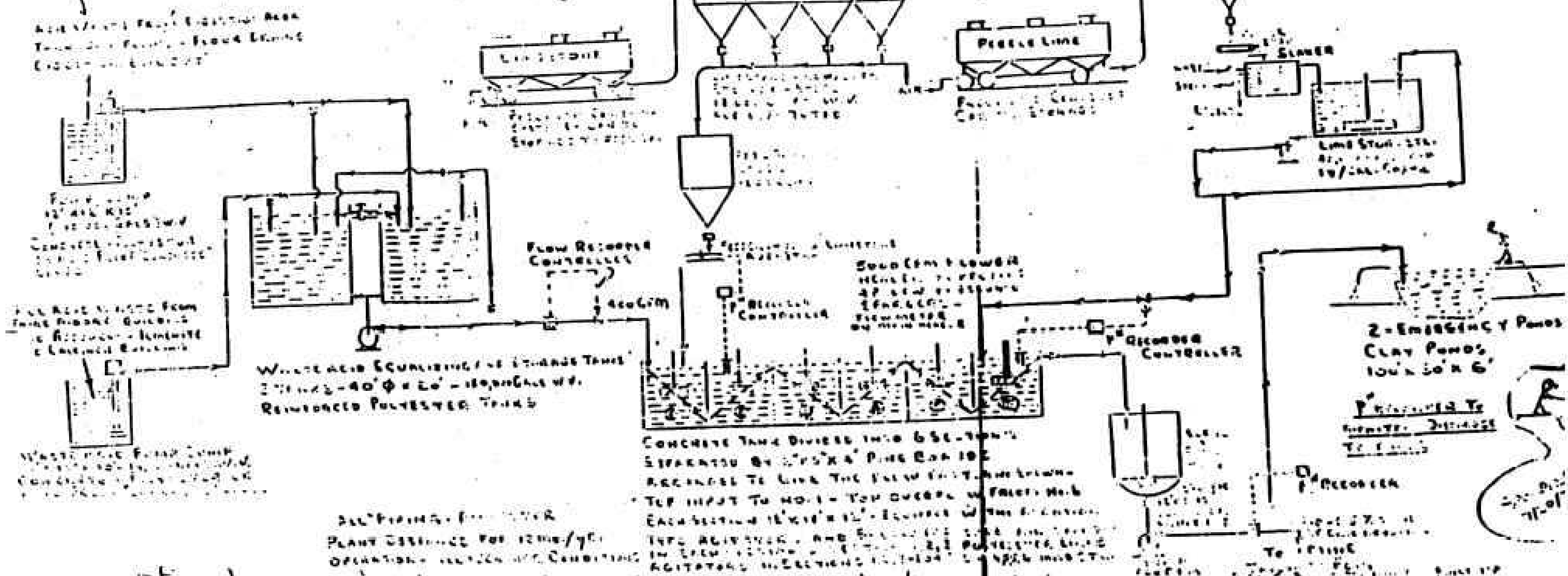
I ask that you advise me as soon as possible on the disposition of our request. Thank you for your attention to this matter.

Sincerely,

Jerome C. Muys, Jr.

cc: Philip F. Koren, Esq.
Mr. Raymond Merrell
Margaret R. Tribble, Esq.

This is one of many ... by [illegible] on file [illegible] •



This drawing represents what Cyanamid planned to do in 1970,
This system would neutralize all acid less than 5.0% - Over 5.0% H_2SO_4 would be
Concentrated and used back in the process.
Copperas $FeSO_4 \cdot 7H_2O$ does not exist in the buried Sumps. that
material is a makeup of $FeSO_4$ and other iron compounds.
In 1968 we surveyed the dump to evaluate recovery of
Copperas since our Copperas Sales were higher
than our production.
The present buried material is not having any effect
on wells or surface waters. We have monitored any
acidity (last two years) in Piney River or main ponds
in the immediate area. The buried material [illegible]
continues [illegible] and settle —

Swidler & Berlin
Chartered
3000 K. Street, N.W.
Suite 300
Washington, D.C. 20007-3851

Jerome C. Muys, Jr.
Attorney-At Law

Direct Dial
(202) 944-4947
Telex: 701131
Telecopier: (202) 944-4296

August 16, 1989

VIA FEDERAL EXPRESS

Ms. Jamie Walters
Community Relations Coordinator
Department of Waste Management
18th Floor, Monroe Building
101 N. 14th Street
Richmond, VA 23219

Timothy Longe, Ph.D.
Remedial Project Officer
Department of Waste Management
18th Floor, Monroe Building
101 N. 14th Street
Richmond, VA 23219

Re: U.S. Titanium Site,
Piney River, Virginia

Dear Ms. Walters and Dr. Longe:

I am writing on behalf of American Cyanamid Company to request a fourteen-day extension of the public comment period (until September 13, 1989) on the "proposed remedial action plan" for the U.S. Titanium Site in Piney River, Virginia. This request is prompted by our recent receipt of the administrative record file index of documents for this site, which is forty pages in length.

Section 117(a)(2) of CERCLA requires that the State provide a "reasonable" opportunity for the submission of written comments regarding any plan for remedial action. By our count, the administrative record in this matter contains approximately fifteen volumes of documents containing thousands of pages of information, including a large number of internal agency documents of which we previously were unaware or which were unavailable to us. While it is not our intention to delay the remedy selection process for the site, we do not think it is reasonable for the State to expect us to prepare meaningful comments in thirty days, particularly in light of the fact that the proposed remedial action plan for the site departs in significant respects from the "recommended remedial action" contained in the Feasibility Study.

APPENDIX B

Supplemental Information

PERFORMANCE AND PAYMENT BONDS
U.S. Titanium Responsiveness Summary

QUESTION: Are the contractors that do the remedial work required to be bonded?

RESPONSE: Whether performance and/or payment bonds are required is dependent on several things: is the site is a fund-lead or an enforcement-lead; has a Potentially Responsible Party (PRP) been identified; or is the contract a construction or service contract. The definition of a construction contract, under the Federal Acquisition Regulations (FAR) can include remedial activity.

While there is no specific language in the Superfund laws that require bonding for remedial activity contractors, the concept of bonding can be generally construed in several sections.

CERCLA §119 (a) states that a response action contractor is not liable under any federal law for injuries, costs, damages, expenses, or other liability which results from any release of hazardous substances; it does not except contractors from liability for Workman's Compensation, negligence or warranty.

§119 (c) holds that the government may indemnify the response contractor for negligence or intentional misconduct during the response action.

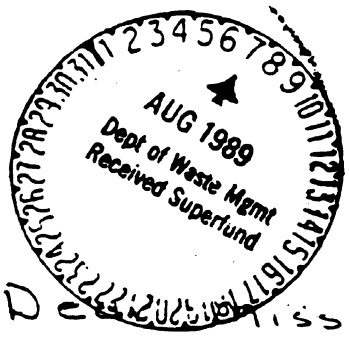
40 CFR §300.68(l) of the National Contingency Plan (NCP) as a *collateral matter*: when a person other than the lead agency takes response action, the lead agency has to approve the adequacy of the response plan and the contractor. Where the response action is a fund-lead contracted by the U.S. EPA, the Federal Acquisitions Regulations (FAR) apply to formation of the contract.

Under **§28.102-1 and §28.103-1** of the **Federal Acquisition Regulations** (FAR), bonding is required whenever the Federal government is liable for the completion of the work. The Federal Acquisition Regulations must be followed for the contractor to do response work.

Where the response action is an enforcement-lead action and a PRP is responsible for the completion of the work, the PRP can determine whether or not it will require a bond from the contractors. In such cases, the State and Federal government look to the PRP to ensure that the response work is completed. Because the PRP is liable in an enforcement-lead action, the government never gets directly involved in the contracting process between the PRP and the response action contractor, except as noted above. If the contractor defaults, government can demand that a new contractor be selected to complete the work. The government also has the option to redesignate the status of the site to a fund-lead, use Superfund monies to undertake the response action, and initiate cost recovery action.

APPENDIX C

Citizen Letters and Comments including Comments Submitted by American Cyanamid Company



Stephen A. Lamanna
P.O. Box 158
Amherst, VA. 24521

Dear Miss Walters,

I am sorry that I will be out of town on August 9, and cannot attend your meeting.

I have reviewed the Hydrosystems report and feel that most of it would be a waste of time and money.

When you find the drums at PIC, you will find most of them full of slag and concrete.

Sincerely,

Stephen A. Lamanna

Again my thanks for the information you presented at the meeting an your willingness to take the time to explain your procedures and the clean-up plan to the public. I would appreciate receiving information on how the plan is proceeding and if at any time the public is allowed to participate I would like to be informed.

Sincerely,

Pople Martin

Pople Martin
Rt. 4, Box 392
Amherst, Virginia 24521
804-277-5510

COLLEGE OF ENGINEERING

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061-0246

THE CHARLES EDWARD VIA, JR, DEPARTMENT OF CIVIL ENGINEERING
ENVIRONMENTAL ENGINEERING AND ENVIRONMENTAL SCIENCES (703) 961-6131

September 12, 1989

Ms. Jamie Walters
Community Relation Officer
Department of Waste Management
101 N. 14th Street 18th Floor
Richmond, VA 23219

Dear Ms. Walters:

I have just received a copy of the letter to you from Mr. Stephen A. Lamanna regarding pH levels at Piney River. Based on my measurements and a review of the materials provided by others, I believe that there is no possibility that his pH measurements are correct.

I appreciate the interests in citizens to limit the expenditure of money for unnecessary cleanups but in this case, widespread contamination of the groundwater, soil, and the Piney River have been demonstrated by the state, EPA, and several private contractors representing all parties involved in the cleanup program. If the material presented by Mr. Lamanna becomes an issue, I am willing to provide technical assistance to show that the information he provided is erroneous.

Sincerely,

John T. Novak
Nick Prillaman Professor
of Environmental Engineering

JTN/bpw

P.O. Box 158
Amherst, Va. 24521
Sept. 4, 1989

Jamie Walters
Community Relation Officer
Department of Waste Management
101 N. 14th Street 18th floor
Richmond, Va. 23219

Miss Walters

On Wednesday August 23, 1989, I made a survey of the Piney River: the area surrounding the residue area and the top of the residue pile. Results are as follows:

- Piney River Up-stream of Plant

  Water Clear, pH = 7.0

- Piney River - Discharge Point of Creek Drain (wet area west of Rt. 151 - old spring - Cyanamid drinking water)

  Water Clear, pH = 7.0, Flow = 20-30 gpm

- Down River of Plant

  Water Clear, pH = 7.0

- Pond in Road Below Residue Pile

  Water Slight Amber, pH = 6.95

- Ditch along old R.R. bed below Residue "dump"

  No flow, pH = 7.0

- Flow from area where Copperas was originally stored

  Flow to River = 8-10 gpm, Water Clear, pH = 7.0

  (This is the 4.5 acre tract shown in the attached report. Any seepage from the buried Copperas residue would drain to this area.)

- Top of Residue Top

  Water standing in eroded ditch, Color Amber, pH = 6.8

The lower part of the buried residue area is exposed as a result of washing. From the surface it appears to be more erosion and very little if any solution.

The plant and residue burial areas are overgrown with high weeds and the roads have either been blocked off or eroded to the point that access is almost impossible. Walking in to the river and the residue burial area is the only way. Copperas ($FeSO_4.7H_2O$) which is readily water soluble does not exist in the buried material. It is primarily products of the dehydration and oxidation of the material stock piled. I am attaching a report issued in April, 1971 which shows the results of a drilling program where we were trying to evaluate the material in the 4.5 acre Copperas dump. At that time Copperas sales exceeded our copperas production and we were seeking another source of Copperas. On the basis of the poor quality of the material in the dump, the possible recovery program was discontinued. The analysis of the drilling shows how the material degrades and becomes less water soluble. Bear in mind there has not been any Copperas added to this system in the past 18 years. What buried now is essentially water insoluble residues.

The report shows that the Copperas dump area covered 4.5 acres - 196,200 square feet. This large surface during heavy rains washed off a large amount of water soluble ferrous sulfate which, when not controlled resulted in a drop in river pH which caused a fish kill. That is what happened in 1977.

The data collected and conditions as they now exist shows that it is not a problem. With no chances at all that a fish kill can O C C U R . There is not enough soluble ferrous sulfate in the entire area to cause a fish kill, even with the most severe weather conditions. The data also shows that due to no liquid flow or seepage from the residue area that ground water is not in any way affected.

I repeat you really have to know where to look to find the buried residue. It is time to quit hollering wolf and pick a qualified technical committee to review the situation and put this problem to bed.

Sincerely,

Stephen A. Lamanna

Stephen A. Lamanna

COPPERAS DUMP "AS IS"

Sample No.	Hole No.	Depth Ft.	Total Acid As % H_2SO_4 Water Sol.	Water Sol. As % $FeSO_4$	Total Iron As $FeSO_4$	Insol. Iron As $FeSO_4$	% Insol. $FeSO_4$ Basis	Insol. Iron As % Fe_2O_3
1	1	10	28.2	43.74	53.3	9.56	17.94	5.03
2	1	15	29.4	45.6	48.9	3.3	6.75	1.74
3	2	10 wet	36.0	55.84	53.7	-	-	-
4	2	12 W	17.4	26.99	54.2	27.21	50.2	14.32
5	3	10	32.4	50.26	53.7	3.44	6.41	1.81
6	3	20 W	18.0	27.92	47.4	19.48	41.1	10.25
7	4	10	34.8	53.98	54.7	0.72	1.32	0.38
8	4	15 W	32.4	50.26	38.1	-	-	-
9	5	10	12.0	18.61	52.8	34.19	64.75	17.99
10	5	15 W	32.4	50.26	61.1	10.84	17.74	5.71
11	6	10	32.4	50.26	53.7	3.44	6.41	1.81
12	6	15 W	22.2	34.43	64.4	29.97	46.54	15.77
13	6	20 W	8.4	13.03	52.8	39.77	75.32	20.93
14	7	10	7.8	12.1	53.7	41.6	77.47	21.89
15	7	15 W	21.6	33.5	65.1	31.6	48.54	16.63
16	7	20 W	18.6	28.85	71.8	42.95	59.82	22.6
17	8	10	33.0	51.19	54.6	3.41	6.25	1.79
18	8	20	34.2	53.05	54.6	1.55	2.84	0.82
19	8	25	25.8	40.02	49.8	9.78	19.64	5.15
20	8	30 W	22.8	35.37	45.9	10.53	22.94	5.54
21	9	10	32.4	50.26	53.1	2.84	5.35	1.49
22	9	20	33.0	51.19	53.1	1.91	3.6	1.0
23	9	30	32.4	50.26	53.1	2.84	5.35	1.49
24	9	35	30.6	47.46	52.6	5.14	9.77	2.71
25	9	40 W	21.0	32.57	42.9	10.33	24.08	5.44
26	10	10	30.0	46.53	54.1	7.57	13.99	3.98
27	10	20	30.0	46.53	48.8	2.27	4.65	1.19
28	10	30	34.2	53.05	52.6	-	-	-
29	10	40 W	28.2	43.74	51.3	7.56	14.74	3.98

CONFIDENTIAL

INTEROFFICE CORRESPONDENCE

Piney River, Va. - April 29, 1971

OFFICE BLDG/TUBE RM# DATE

TO: Piney River Office

ATT'N. OF: Mr. J. F. Hopkins

COPY TO: Mr. J. J. Fitzgerald -N
Mr. Emil Hladky -N
Dr. C. P. Priesing -N

SUBJECT: COPPERAS "DUMP"

REFERENCE:

The Piney River Plant started stockpiling copperas July, 1949. Since that time all copperas not sold was hauled to the copperas "dump". The top of the present dump contains 4.5 acres.

The dump has been surveyed and drilled to determine the quality and quantity of coppers contained.

It has been estimated that the area contains approximately 200,000 tons of material. Analysis taken at various depths from ten drill holes show that the material contains from 7.8 to 36.0% total acid as H_2SO_4 (water soluble). The percent insoluble material calculated as $FeSO_4$ varies from 1.32 to 77.47%. X-ray diffraction analysis show the "pile" to contain $FeSO_4$, $FeSO_4.H_2O$, $FeSO_4.4\ H_2O$ and $FeSO_4.7H_2O$.

Attached are tables containing the analysis of the drill samples, the results of the x-ray analysis and a map of the pile showing the area and elevations.

Stephen A. Lamanna

Stephen A. Lamanna

SAL/jes

Attachments

* 9/1/89
a large tonnage of soluble ferr
was washed to the river before
the remaining material was bur

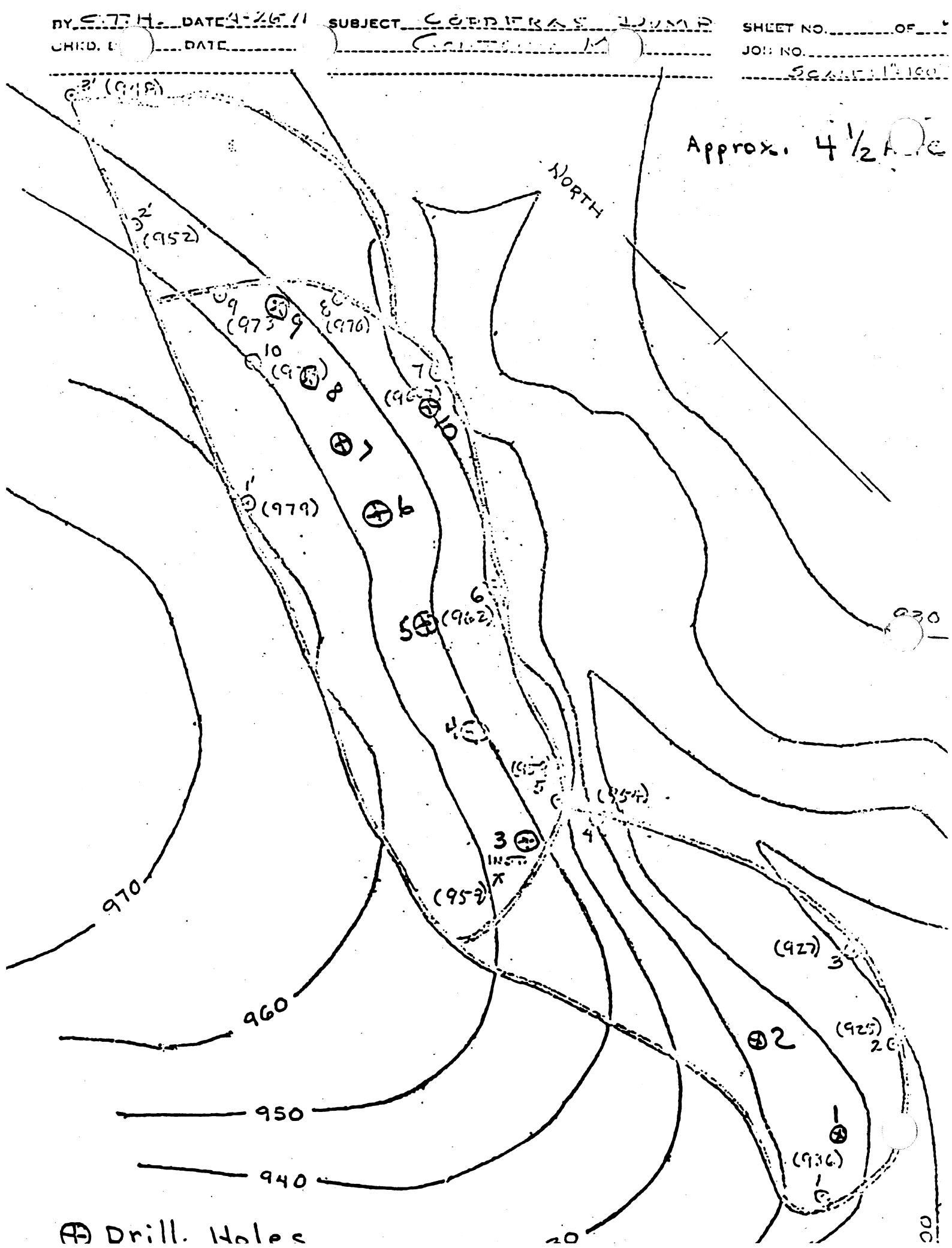
X-RAY DIFFRACTION ANALYSIS

Hole No.	Depth Ft.	$FeSO_4$	$FeSO_4.H_2O$	$FeSO_4.4H_2O$	$FeSO_4.7H_2O$
1	15	little	little	little	mostly
2	10	little	little	little	mostly
3	10	little	little	little	mostly
4	10	little	little	some	some
5	10	little	some	some	lot
6	10	little	little	some	some
7	10	little	little	some	some
8	25	little	little	mostly	some
9	30	little	little	mostly	some
10	30	little	little	mostly	little or none

Any oxides present were in such small amounts that their major lines were obscured by the minor lines of the sulfates.

BY S.T.H. DATE 4-26-71 SUBJECT CORRITRAC DUMP SHEET NO. ____ OF ____

CHKD. ____ DATE ____ JOB NO. ____



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SEPTEMBER 15, 1989

Ms. Jamie Walters
Community Relations Officer
Department of Waste Management
101 N. 14th St., 18th Floor
Richmond, Virginia 23219

Re: American Cyanamid Plant, Piney River, Virginia

Dear Ms. Walters:

I attended the meeting involving the American Cyanamid clean-up at Piney River that was held this summer under the auspices of the Waste Management Department and the EPA. I was pleased that such thoughtful scientists had been involved in the process of developing the clean-up proposal. I was concerned, however, that American Cyanamid might be placed in charge of the actual clean-up since I don't believe that they have ever expressed an opinion that there is a serious problem at the site and do not appear to be committed to cleaning it up. Rather they will probably do the minimum necessary to avoid sanctions under the law.

I believe the better approach to solving this problem would be for the EPA to clean up the site and send the bill to American Cyanamid.

I also believe that the solution proposed by the EPA scientists at the meeting appears to be a proper solution, except that I think that there should be increased monitoring of wells installed around the site. Monitoring should include a number of private wells of homes in the area which can be used as base line test wells to determine if any of the material is leaking off the site. If you have a half a dozen to ten homes that you are monitoring which show no acid or hazardous metals in their water today, then if we keep monitoring them we will notice any change for the worse. If in fact they have acid or hazardous metal in their water today then we know that the problem from the American Cyanamid plant is far more serious than we had anticipated.

I hope that you will ensure that these suggestions are

factored into the final decision as to the type of remedial action to be taken and the methods used to monitor the results.

I trust your organization will continue to oversee the clean-up and that there will be sufficient supervision, bonding, etc. to ensure that the contractors that actually do the work to implement the plan do it properly so that we have a permanent solution.

Thank you for your help in this matter.

Sincerely,

Stephen C. Martin

SCM:bh

TELEPHONE MEMORANDUM
JAMIE WALTERS

NAME OF CALLER: Robert Forman **DATE/TIME:** 8/11/89, 3:20 P.M.

ADDRESS/PHONE: 106 Wendover Lane, Charlottesville, Va. 22901/804-293-6628

SUBJECT MATTER: U.S. Titanium Proposed Plan for Cleanup

SUMMARY OF CALL: Mr. Forman called me earlier in the day, I returned his call, and then he called me back at 3:20 p.m. He said he is a former employee of the Department of Waste Management, and worked on the U.S. Titanium site. He said he wrote a good number of negative reports and memos about the U.S. Titanium site. At that time, he said he and Walt Gulevich wrote reports and investigations that said the copperas, when interacting with water, would turn to sulfuric acid and that would eat through any clay liner/cap. He said that William Gilley approved the cap in 1980 anyway, despite their reports that it would get eaten and fail.

He said he was last out at the site in 1987; he claims the burial pit is about 100 ft. wide and 8 ft. deep. According to him, Area 3 residue was also put in the landfill in area 1, after the lagoon was allowed to evaporate.

Mr. Forman claims that if the cap had been done correctly, there would have been no problem. But the cap was built incorrectly, not according to proper specifications, and wasn't maintained.

He read about the "lemon juice" comment from the public meeting, and was "furious" because he said if you put a fish in lemon juice, it'll die.

He said that the Amherst side lagoons were tested and found not to be a problem. Herbert Bryant bought those and used the residue for fertilizer.

He called primarily to let us know that he agrees totally with Hydrosystems/American Cyanamid that the area has been leached so much that not much of danger remains. He thinks it would be a waste of money to spend $6 million when a good cap would do the job. He said the site isn't that big of a deal, and shouldn't waste taxpayers money.

He said he was familiar with Woody Greenberg, Sierra Club member who is now running for Board of Supervisors and attended the 8/9 meeting, and that Mr. Greenberg didn't have any experience whatsoever to base his opinions on where it concerns technical matters at the site and the actual dangers. He said Mr. Greenberg just wants to make a big deal out of it because he's running for Supervisor.

He wanted to let us know that he would support Cyanamid in court with his "experience with the site." He spoke earlier today with a Hydrosystems staff person who said that "you couldn't understand a word that Longe, the guy from EPA, said." I let him know that the presenter was from our staff, not EPA. He said it didn't matter, the same was still true.

All in all, he plans on working with Cyanamid in any way. "Some bureacrat didn't do his job right when he picked the cap for 1980, and now someone else is taking the blame for it."

SWIDLER & BERLIN

CHARTERED
3000 K. STREET, N.W.
SUITE 300
WASHINGTON, D.C. 20007-3851

Jerome C. Muys, Jr.
ATTORNEY-AT LAW

Direct Dial
(202) 944-4947
Telex: 701131
Telecopier: (202) 944-4296

September 28, 1989

VIA FEDERAL EXPRESS

Timothy Longe, Ph.D.
Remedial Project Manager
Department of Waste Management
18th Floor, Monroe Building
101 N. 14th Street
Richmond, Virginia 23219

Re: U.S. Titanium Site,
Piney River, Virginia

Dear Dr. Longe:

The enclosed document, together with the accompanying submissions by Hydrosystems, Inc. In-situ, Inc., Mr. Michael Nawrocki and Albert C. Hendricks, Ph.D., and Mr. William Trees, constitute the comments of American Cyanamid Company on the "Proposed Remedial Action Plan" for the U.S. Titanium Site in Piney River, Virginia. We ask that these comments be included in the administrative record for the site.

As explained more fully in the enclosed comments, the only remedial measures supported by the administrative record for this site are those recommended in the Feasibility Study. Assuming negotiation of a satisfactory settlement document, we are prepared to implement those measures as soon as agreement can be reached with the necessary parties.

First, in accordance with the Feasibility Study, we propose to collect and treat, via a wetland treatment system, groundwater originating in the vicinity of areas containing copperas and/or acidified soils (Areas 1, 2, 3, and 4). To that end, we have retained Albert C. Hendricks, Ph.D. and Michael A. Nawrocki, experts in the field of wetland treatment system design and operation, to advise regarding the construction of such a system at the U.S. Titanium Site.

Second, we propose to implement drainage controls and construct a vegetated soil cover on the sedimentation ponds (Area

5). This measure would eliminate impacts to the Piney River associated with the erosion of acidified sediments in this area and any violations of water quality standards which might result therefrom.

Third, we propose to construct an impermeable cap on the copperas burial pit (Area 1). This measure would virtually eliminate infiltration into the burial pit, providing a level of protection equivalent to that afforded by dissolution alternatives.

In sum, these measures would satisfy the remedial objectives for the site by reducing the acidic and iron-bearing discharges to levels that would not have significant adverse impacts on the aquatic life downstream of the site. The recommended actions also would achieve compliance with "applicable, relevant and appropriate requirements" by eliminating the potential for violation of water quality standards.

In addition, the remedial measures recommended in the Feasibility Study could be implemented relatively quickly. In contrast, should the agencies reject the recommended containment alternative for Area 1, it would be necessary to conduct extensive laboratory, bench-scale, and field studies to evaluate the feasibility, cost, and overall effectiveness of the dissolution alternatives. A further significant consideration would be the fact that the dissolution alternatives (with the possible exception of the resource recovery option) would generate substantial amounts of sludge that would need to be landfilled on site. This would render such alternatives no more "permanent" than the containment option recommended in the Feasibility Study.

In light of the foregoing and the enclosed comments, we would like the opportunity to meet with you as soon as possible. We will be contacting you shortly to discuss the scheduling of a meeting.

Sincerely,

Jerome C. Muys, Jr.

Jerome C. Muys, Jr.

JCM/lc
Enclosure

cc: Philip F. Koren, Esq.
Ms. Jamie Walters
James T. Heenehan, Esq.
Mr. Paul Leonard

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COMMENTS OF AMERICAN CYANAMID COMPANY ON THE PROPOSED REMEDIAL ACTION PLAN FOR THE U.S. TITANIUM SITE, PINEY RIVER, VIRGINIA

I. INTRODUCTION

This document and the accompanying submissions by Hydrosystems, Inc., In-Situ, Inc., Mr. Michael A. Nawrocki and Albert C. Hendricks, Ph.D, and Mr. William Trees (which are incorporated herein by reference) constitute the comments of American Cyanamid Company ("American Cyanamid") on the "Proposed Remedial Action Plan" for the U.S. Titanium Site in Piney River, Virginia. We ask that these comments be included in the administrative record for this site.

American Cyanamid is concerned about site conditions and their potential impact on the Piney River. The Company has demonstrated this through its agreement to conduct the Supplemental Remedial Investigation ("RI") and the Feasibility Study ("FS") for the site, and through its voluntary efforts to implement temporary repair measures at the site pending completion of the studies.

The RI/FS, which was conducted by Hydrosystems, Inc., focused on seven areas of the site which had been identified by earlier investigations as potential sources of iron and acidic discharges to the Piney River. Consistent with the conclusions of the prior investigations, the RI found that the acidic soils, surface water and groundwater at the site do not present any risk to human health, but that there had been impacts to the aquatic community in the Piney River as a result of the acidic and iron-bearing discharges.

In light of the earlier studies and the data collected during the RI, the FS identified the remedial objective for the site to be the elimination and/or reduction of the acidic surface water and groundwater discharges to the Piney River to a level which would not have significant adverse impacts on the aquatic life downstream of the site. The FS identified an additional

remedial objective to be reduction of the flux of iron to the Piney River to a level which would minimize impacts on aquatic life.

Based on the findings of the previous investigations and on the remedial objectives which were identified in the RI, potential technologies were screened during the FS and remedial action alternatives were formulated. Screening of alternatives was conducted on the basis of implementability, effectiveness, and cost.

Significantly, the State and EPA would not authorize Hydrosystems to conduct as part of the FS the laboratory and field scale studies which Hydrosystems had concluded were necessary to evaluate alternative remedial approaches for the site. As explained below, this decision, occasioned by the desire of EPA and the State to expedite the FS process, has resulted in a major gap in the technical data supporting the State's proposed remedial action plan for the site.

In the absence of laboratory and field data, a detailed analysis of the remedial alternatives was conducted during the FS based primarily on available literature. Each alternative was evaluated based on analysis of performance, risk reduction, reliability, implementability, safety, environmental considerations, public health, institutional issues, and cost. A comparative analysis was then performed, in which the alternatives were compared to identify and evaluate the key trade-offs between the alternatives.

Based on the comparative analysis, a comprehensive remedial program for the site was recommended in the FS. The recommended remedial program included installation of a passive groundwater collection and treatment system (to be located in "Area 7"), capping of the copperas burial pit ("Area 1"), repair of the unvegetated areas surrounding the groundwater seeps along the base of the reclaimed slope ("Area 2"), and construction of drainage controls and placement of a vegetated soil cover in the area of the former sedimentation ponds ("Area 5"). No additional action was recommended for Areas 3 and 4 (beyond collection and treatment of acidic groundwater originating in those areas), because of the minimal contribution of those areas to acidic conditions at the site. "No action" was recommended for Areas 6 and 7, because Area 6 had been determined to be non-acidic and Area 7 would receive incidental remediation as a result of the installation of the groundwater collection and treatment system.

The FS, including the recommendation for remedial action, was submitted to the State and EPA on or about November 20, 1988. On March 15, 1989, the State provided written comments on the FS to Hydrosystems. Hydrosystems responded to the comments

and supplemented the FS by letter dated April 18, 1989. Shortly thereafter, Hydrosystems was advised that the State planned to announce its "Proposed Remedial Action Plan" for the site on July 31, 1989.

Less than two months before the State's planned announcement of a cleanup plan for the site (and approximately seven months after Hydrosystems' submission of the FS to the State), Hydrosystems was advised that the State was considering a remedial technology for Area 1 which had not been addressed in the FS and had never been suggested as a possible approach in any of Hydrosystems' discussions, with the State. As explained below, Hydrosystems reluctantly agreed to assess this additional alternative, referred to as "in-situ dissolution and treatment of leachate" under very tight time constraints and without a full opportunity to evaluate the feasibility of the approach or to compare this approach with other treatment alternatives. This resulted in the submission of an "addendum" to the FS on July 18, 1989.

The "Proposed Remedial Action Plan" announced by the State on July 31, 1989 incorporated the passive groundwater collection and treatment approach recommended in the FS, as well as the remedial alternatives recommended for Areas 2 and 5. However, the State rejected the recommendation in the FS that Area 1 be capped, electing instead the "in-situ dissolution and treatment" alternative which had been identified only weeks before. The State also proposed "improved surface drainage" for Area 3, "drainage control and revegetation" for Area 4, and "above-grade dry neutralization" for Area 7.

We strongly support the State's selection of a passive groundwater collection and treatment system, as well as its concurrence in the remedial alternatives recommended in the FS for the reclaimed slope and the former sedimentation ponds. However, we do have a number of comments on the establishment of effluent limitations and/or other performance standards for the discharge from the wetland treatment system, and we have been advised that we will have a full opportunity to provide such comments during the remedial design/remedial action phase of the cleanup. Enclosed for inclusion in the administrative record are copies of correspondence between American Cyanamid and State representatives confirming this understanding.

We do, however, take issue with other remedial measures proposed by the State. With respect to the in-situ dissolution and treatment alternative proposed for Area 1, the record is grossly inadequate and incomplete. Because of the extremely short time frame within which this alternative was identified and had to be evaluated, it was not subjected to the required "comparative analysis of alternatives" set forth in the FS with respect to the

other alternatives, and was selected without benefit of the laboratory and field scale studies which are necessary to determine whether treatment alternatives (including resource recovery) are feasible and cost effective at this site. Moveover, the studies conducted by the State, and EPA, as well as the RI conducted at their direction, support the conclusion that she site does not pose a significant threat to the environment and that remediation of Area 1 beyond that recommended in the FS is not necessary or cost-effective.

We also take issue with the remedial alternatives proposed for Areas 3 and 4. However, as explained below, if remediation of those areas is to be undertaken (beyond groundwater collection and treatment), it should be limited to those locations where natural revegetation has not yet occurred. There is no reason to disturb areas which have already revegetated naturally.

Comments on each of these specific issues are set forth more fully below. As previously discussed, we expressly reserve the right to comment on any effluent limitations and/or performance standards for the wetland treatment system at the appropriate time.

II. COMMENTS ON IN-SITU DISSOLUTION AND TREATMENT OF LEACHATE AS THE PROPOSED REMEDIAL ALTERNATIVE FOR AREA 1

A. The Administrative Record does not Support the Selection of a Treatment Alternative for Area 1

Section 121(a) of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), added to the statute by the Superfund Amendments and Reauthorization Act of 1986, provides that "[t]he President shall select appropriate remedial actions determined to be necessary . . . which are in accordance with this section and, to the extent practicable, the national contingency plan, and which provide for cost-effective response." Pending revision of the national contingency plan to conform to the 1986 amendments, EPA published a document entitled "Interim Guidance on Superfund Selection of Remedy," dated December 24, 1986, which constituted EPA's interpretation of the new statutory requirements on the CERCLA remedy selection process.[1/]

1/ This document (copy attached) is hereinafter referred to as "Interim Guidance." The Interim Guidance was expanded in EPA's "Interim Final Guidance on Preparing Superfund Decision Documents" dated June 1989 ("ROD Guidance") and in its "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" dated August 1988 ("RI/FS Guidance").

According to the interim Guidance, the 1986 amendments required a number of changes in the procedures under which CERCLA remedial actions would be selected. For example, the Interim Guidance provides that remedial investigations may need to be conducted in at least two phases to allow for bench-scale or pilot-scale testing of treatment technologies.[2/] The second phase, the post-screening field investigation, focuses on the collection of data sufficient to make a well-substantiated remedy selection decision, and may involve the testing of a particular technology on the waste site itself.[3/]

According to the RI/FS Guidance, "data collected during site characterization may not always be adequate for assessing the feasibility of remedial technologies, and, in fact, the need for detailed data from treatability tests may not become apparent until the initial screening of alternatives has been completed."[4/] Treatability testing is deemed unnecessary where "technologies have been demonstrated sufficiently so that site-specific information collected during site characterization is adequate to evaluate and cost those technologies without conducting treatability testing."[5/] Treatability testing may not be necessary where "[a] developed technology is well proven on similar applications" and where "[s]ubstantial experience exists with a technology employing treatment of well-documented waste materials."[6/]

The RI/FS Guidance further provides that "[w]here treatment performance is difficult to predict, an actual testing of the process may be the only means of obtaining the necessary data."[7/] Moreover, "in some situations it may be more cost-effective to test a process on the actual waste than it would be to characterize the waste in sufficient detail to predict performance."[8/] In sum, "[t]reatability testing performed during an RI/FS is used to adequately evaluate a specific technology.

2/ Interim Guidance at 2; RI/FS Guidance at 6-2.

3/ Interim Guidance at 3; RI/FS Guidance at 7-4 - 7-6.

4/ RI/FS Guidance at 6-4.

5/ RI/FS Guidance at 6-6.

6/ Id. (emphasis added).

7/ Id.

8/ Id.

including evaluating performance, determining process sizing, and estimating costs in sufficient detail to support the remedy-selection process."[9/]

With respect to bench-scale treatability studies, the RI/FS Guidance states that these "are typically performed for projects involving treatment or destruction technologies."[10/] Bench-scale tests "may also be conducted for well-developed and documented technologies that are being applied to a new waste."[11/] "Alternatives involving treatment or destruction technologies require some form of treatability testing, if their use represents first-of-its-kind applications on unique or heterogeneous wastes."[12/]

With respect to the final selection of a remedial program, the various EPA guidances conclude that CERCLA requires the selection of a remedial alternative which meets the following four criteria:

(1) the remedy is protective of human health and the environment;

(2) the remedy satisfies applicable or relevant and appropriate requirements;

(3) the remedy is cost-effective;

(4) the remedy utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.[13/]

As explained in detail below, the administrative record for this site is inadequate to support the selection of a treatment alternative for Area 1 because the State and EPA did not permit the conduct of the laboratory and field studies necessary to evaluate treatment alternatives, because the "in-situ dissolution and treatment" alternative was not subjected to the required "comparative analysis of alternatives," and because the section 121 remedy selection criteria were misapplied.

9/ RI/FS Guidance at 6-7.

10/ Id.

11/ RI/FS Guidance at 6-8.

12/ RI/FS Guidance at 6-11.

13/ Interim Guidance at 4; ROD Guidance at 2-14; RI/FS Guidance at 5-10 - 5-12.

B. Treatment Alternatives were not Subject to Necessary Laboratory and Field Studies

As discussed above, the Interim Guidance and other EPA guidance construing the 1986 amendments to CERCLA provide for the conduct of bench-scale and pilot-scale studies where necessary to evaluate alternative treatment technologies. Shortly after the enactment of the 1986 amendments, EPA directed its regional offices (in conjunction with the appropriate state agencies) to examine ongoing projects (such as the U.S. Titanium matter) and draft a list of potential changes that would be necessary to satisfy the new statutory provisions.[14/] The regional offices were directed to notify potentially responsible parties conducting RI/FSs of the new requirements and to discuss with them any necessary modifications of their work plans.[15/]

Consistent with the Interim Guidance, EPA set forth in a letter dated February 6, 1987 (copy attached), a discussion of the new requirements as they applied to the FS for the U.S. Titanium Site. The letter provided, in pertinent part, that "American Cyanamid and their contractor Hydrosystems will be required to evaluate permanent solutions, alternative treatment technologies or resource recovery technologies during the FS process" and that "a continuation of the Laboratory and Bench Scale studies presented in the [remedial investigation]" may be necessary.

In accordance with the February 6, 1987 letter from EPA, Hydrosystems submitted to the State and EPA, on October 16, 1987, a draft FS work plan (copy attached) which provided for the conduct of post-screening field investigations (to define potential acidity in direct runoff from the site and to determine acidity in the Piney River) and treatability testing (to evaluate technologies for neutralizing the soil/copperas mixture in Area 1 and to evaluate biological treatment alternatives). At that time, the State and EPA were advised that the required laboratory and bench scale studies would add at least 210 days to the originally scheduled 90 day study period. Additional information regarding the treatability testing and the expected time frame for the testing was provided to the State and EPA by letter dated November 25, 1987 (copy attached).

Because of the additional time associated with the proposed treatability testing, the State and EPA insisted that any such testing be deferred until after issuance of the Record of Decision. However, as explained in the attached report by In-situ, Inc., laboratory and field testing is necessary to generate

14/ Interim Guidance at 2.

15/ Id.

information sufficient to evaluate the feasibility and cost-effectiveness of in-situ dissolution alternatives (and possibly other treatment alternatives) as opposed to containment options.

For example, before deciding whether in-situ dissolution is the appropriate approach for Area 1, it is critical to determine if such an approach would exacerbate site conditions by promoting the formation of high conductivity pathways for the copperas leachate, thus creating a mechanism for increased transport of the leachate to groundwater. As discussed in In-situ, Inc.'s report, the likelihood of such an occurrence could be evaluated by, for example, the installation of approximately 10 piezometers in Area 1 to monitor water levels during field trials. In the absence of precipitation, the steady state water level decline would give an indication of the leakage rate from the burial pit during the field study.

Moreover, laboratory and field studies are necessary to determine whether the handling and disposal of the sludge that would be generated as part of the in-situ dissolution and treatment of leachate option would be so problematic that it would render the entire approach infeasible. As explained in the attached letter from Mr. William Trees of Kemira, Inc., a major titanium dioxide processor, the high liquids content of the sludge can be expected to pose serious obstacles and necessitates examination of possible approaches for stabilizing the material.

In addition, In-Situ, Inc. points out that it is necessary to evaluate dissolution efficiencies during field studies before it can be determined whether such an is approach appropriate to this site. It obviously would not be cost effective to implement the in-situ dissolution approach, only to find that, because of the nature of the soil/copperas matrix or for other reasons, the material cannot be uniformly dissolved.

Finally, laboratory and field studies are imperative to allow for full evaluation of resource recovery options. As explained in its report, In-situ, Inc. has concluded that an in-situ dissolution approach followed by recovery of product may hold great promise, and could help mitigate the cost of remediation. This approach could involve in-situ extraction of a low value product followed by an upgrading process to produce a higher value product such as ferrous sulfate or ferrous ammonium sulfate. If the necessary studies show this approach to be feasible and cost-effective, it clearly would be preferable to neutralization of the copperas solution followed by burial of the resulting sludge on site, particularly in light of the statutory requirement for assessment of "resource recovery technologies that, in whole or in part, will result in a permanent and significant decrease in the toxicity, mobility, or volume of the hazardous substance, pollutant, or contaminant." See CERCLA section 121(b)(1).

Because the chemical and hydrologic parameters involved in the in-situ leaching approach are very site specific, it is essential to complete the necessary studies prior to comparing the remedial alternatives and the selecting the final remedy. Accordingly, there is at present inadequate support in the Record for concluding that in-situ dissolution and treatment of leachate (or other treatment alternatives) would provide greater, or even equivalent, protection of the environment compared to containment options. The attached report by, In-situ , Inc. identifies the types of laboratory and field scale studies necessary to evaluate treatment alternatives, including possible application of resource recovery technologies.

C. The "In-situ Dissolution and Treatment of Leachate" Alternative was not Subject to the Required "Comparative Analysis of Alternatives"

According to the RI/FS Guidance, the "detailed analysis of alternatives" required as part of the remedy selection process in section 300.68(h) of the National Contingency Plan entails, among other things, "a comparative analysis . . . to evaluate the relative performance of each alternative in relation to each specific evaluation criterion."[16/] This is perhaps the most critical component of the feasibility study, given that it provides a procedure for identifying and evaluating the key tradeoffs between the alternatives.[17/]

As previously discussed, because of the circumscribed process by which the State identified "in-situ dissolution and treatment of leachate" as a potential remedial alternative for Area 1, that alternative was not subjected to the required comparative analysis, and thus was not evaluated against other treatment and non-treatment alternatives which may provide an equivalent or superior level of performance at a lesser cost. See 40 C.F.R. §300.68(i). This analysis must be conducted before an informed decision can be made regarding remediation of Area 1.

For example, as discussed above, there are significant feasibility and cost implications associated with the handling and disposal of the sludge that would be generated as part of the in-situ dissolution and treatment of leachate approach (as well as part of the "above-grade wet neutralization" alternative). Those considerations should have been part of the comparative analysis, which might well have shown the dissolution alternative to be less desirable than containment options. The absence of a comparative evaluation of the "in-situ dissolution and treatment of leachate"

16/ RI/FS Guidance at 7-31.

17/ Id.

alternative renders the administrative record inadequate to support the selection of that option as the preferred remedial alternative for Area 1.

D. The Section 121 Remedy Selection Criteria Were Misapplied

1. The Proposed Remedial Alternative for Area 1 is not Necessary to Protect Human Health and the Environment or to Satisfy ARARs

Section 121(b)(1) of CERCLA contains the general requirement that CERCLA cleanups must be protective of human health and the environment. According to EPA guidance, this requirement is satisfied if the remedy meets or exceeds applicable or relevant and appropriate requirements ("ARARs") or health-based levels established through a risk assessment when ARARs do not exist.[18/]

The Remedial Action Plan proposed by the State, as well as the Feasibility Study, identify Federal and State laws regarding surface water quality as the ARARs for the U.S. Titanium Site. The Feasibility Study identifies the key ARARs as the State Water Quality Standard for pH of 6.0 to 9.0 and the State Water Quality Criteria for iron of 1.0 mg/l.

According to Piney River water quality data generated in connection with RI over a period of several years, the pH of the river was observed to be below 6.0 on only five occasions out of a total of 180 samples which were collected. No exceedences of the iron criterion were detected.

The five occasions during which pH excursions occurred were associated with rainfall events which caused acidic sediments from Area 5 to erode and discharge to the river. Accordingly, it was concluded in the FS that the passive collection and treatment of acidic and iron-bearing groundwater originating from Areas 1, 2, 3, and 4, together with measures designed to prevent the erosion of Area 5 during storm events, would prevent potential excursions of applicable water quality standards and criteria. These measures, in conjunction with the preventative measures of capping Area 1 and regrading and revegetating of Area 2, were determined in the FS to be protective of human health and the environment and were recommended as the appropriate remedial alternatives for the Site.

However, EPA and the State apparently concluded that, notwithstanding the determinations in the FS, it was necessary to select a "treatment" alternative for Area 1 which, although it would provide no greater protection for the Piney River, could be characterized by the State as a "permanent" remedy. In fact, as

18/ Interim Guidance at 4.

explained in the attached report from Hydrosystems, Inc., what the proposed plan would do is substitute one landfill for another, at an enormous expense and without commensurate environmental benefit or "permanence." (This flaw is shared by the "above-grade wet neutralization" alternative.) For that reason, the proposed remedial action plan is inconsistent with CERCLA and EPA guidance.

2. The Proposed Remedial Alternative for Area 1 is not "Cost-Effective"

Section 121 of CERCLA also requires that CERCLA cleanups be cost-effective. According to the Interim Guidance, "this [cost-effectiveness] finding requires ensuring that the results of a particular alternative cannot be achieved by less costly methods."[19/] In addition, the Conference Report to the 1986 Superfund Amendments and Reauthorization Act stated that, in determining the cost-effectiveness of a remedial action. EPA must first determine the "appropriate" level of environmental and health protection to be achieved and then select a cost-efficient means of achieving that goal.[20/]

With respect to the U.S. Titanium Site, EPA and the State determined the "appropriate" level of environmental and health protection to be compliance with State water quality standards and criteria for the Piney River. The cost-efficient means of achieving that goal, as set forth in the FS, is the collection and treatment of contaminated groundwater, together with the installation of a vegetative cover on Area 5, capping of Area 1, and regrading and revegetation of Area 2. However, EPA and the State selected a far more costly program which provides essentially the same level of protection. For this reason, the State has proceeded in violation of the requirements of section 121 of CERCLA and EPA guidance.

3. The Proposed Remedial Alternative for Area 1 is not "Practicable"

Section 121(b)(1) of CERCLA calls for the selection of remedies that utilize "permanent solutions" and "alternative treatment technologies" or "resource recovery technologies" to the "maximum extent practicable." EPA guidance provides that "[t]his

19/ Interim Guidance at 4.

20/ See H. Rep. No. 962, 99th Cong., 2d Sess. (1986) (hereinafter "Conference Report") at 245.

determination is interrelated to the cost-effectiveness finding and includes consideration of technological feasibility and availability."[21]/

The legislative history of SARA confirms that permanent remedies are only required to the extent "practicable", and practicability subsumes consideration of cost. The legislative history reflects Congress' "intent that the Administrator take into account several factors in determining whether a solution is practicable, including technical feasibility, cost, state and public acceptance of the remedy, and other appropriate criteria."[22]/ Thus, "[a] technology may be available but not be a cost-effective remedial action under the circumstances, and would, therefore, be ineligible for consideration under section 121."[23]/ Accordingly, "[u]nlike a 'feasible and achievable' standard, this [practicability] standard requires consideration of both technical and nontechnical factors."[24]/

Moreover, the RI/FS Guidance expressly recognizes that CERCLA does not mandate "treatment" in cases where it would not be cost-effective. The RI/FS guidance provides that:

> [t]he use of treatment technologies and, therefore, the development of a complete range of options, may not be practicable at some sites with large volumes of low concentration wastes (e.g., large municipal landfills or mining sites). Remedies involving treatment at such sites may be prohibitively expensive or difficult to implement.[25]/

This "exception" to the general rule favoring treatment alternatives is directly applicable to the copperas landfill at the U.S. Titanium site, which consists of large volumes of low concentration "wastes" resulting from mining-related activities conducted at the site.

21/ Interim Guidance at 4.

22/ 132 Cong. Rec. H9566 (daily ed. Oct. 1986) (remarks of Rep. Lent).

23/ Id. at H9589 (remarks of Rep. Eckert).

24/ Id.

25/ RI/FS Guidance at 1-14.

In selecting in-situ dissolution and treatment as the remedial alternative for Area 1, EPA and the State have selected a "permanent" remedy without the requisite consideration of "practicability," including cost. Therefore, the selection of the alternative is inconsistent with section 121 of CERCLA.

III. COMMENTS ON PASSIVE GROUNDWATER COLLECTION AND TREATMENT SYSTEM

We strongly endorse the proposal to install a passive groundwater collection and treatment system at the site. However, we do have the following preliminary comments regarding the timetable for imposition of any effluent limitations and/or other performance standards for the system. We understand that there will be a full opportunity to comment on any such requirements after the ROD has been issued.

As explained in the enclosed report by Michael A. Nawrocki and Albert C. Hendricks, Ph.D, after installation of the wetland treatment system, a period of time is necessary to conduct field observations and to make adjustments in order to ensure the long term health and effectiveness of the system. Observations of and adjustments in water depths, flow patterns, inflow and outflow controls, and plant growth patterns, among other parameters, must be made throughout a number of growing seasons and hydrologic conditions.

According to Mr. Nawrocki and Professor Hendricks, based on past field experience, as many as three growing seasons may be required to establish plant viability and allow replanting in order to account for some expected plant mortality. Additional time - perhaps two years - may be needed to adjust flow patterns within the wetland. This has been found to be necessary in order to correct possible short circuiting caused by selective growth of mature plant groups and natural, nonhomogeneous decay of the organic substrate.

In sum, a five-year transition period may be necessary to make required adjustments to prevent any degradation in removal efficiencies due to variance in water depths, overall organic substrate decomposition, short-circuiting of flow, storm damage, erosion, or other conditions. Accordingly, effluent limitations and/or other standards for judging the performance of the wetland treatment system should not take effect until the end of the transition period.

IV. Conclusion

The data generated in connection with the supplemental remedial investigation show that excursions of the pH standard the Piney River attributable to the U.S. Titanium are associated

with storm events, which cause erosion of acidified soils in Area 5. Chronic impacts are attributable to an elevated level of iron in the site discharge, which, although it does not result in violation of water quality standards or criteria, impacts the benthic community in the river. These impacts are addressed by the remedial program recommended in the FS. Assuming the participation of other PRPs and negotiation of a satisfactory settlement document, American Cyanamid remains willing and ready to implement remedial measures recommended in the FS. We believe that continued discussions among the interested parties can bring about a mutually satisfactory approach to site remediation.

APPENDIX D

Glossary of Superfund Terms

Commonwealth of Virginia
Department of Waste Management

Fall/Winter 1989

Superfund Glossary

This glossary defines terms often used by the Department of Waste Management and the U.S. Environmental Protection Agency (EPA) staff when describing activities that take place under the Superfund law, CERCLA. The definitions apply specifically to the Superfund Program and may have other meanings when used for other types of programs. Italicized words included in various definitions are defined separately in the glossary. If you still have questions about Superfund Program terms, you can contact your Superfund Program Community Relations Liaison at the Department of Waste Management or the EPA.

Administrative Order on Consent: A legal and enforceable agreement signed between EPA and *Potentially Responsible Parties (PRPs)* whereby PRPs agree to perform or pay the cost of a site cleanup. The agreement describes actions to be taken at a site and may be subject to a public *comment period*. Unlike a *consent decree,* an administrative order on consent does not have to be approved by a judge.

Air Stripping: A treatment system that removes, or "strips", *volatile organic compounds* from contaminated *groundwater* or *surface water* by forcing an airstream through the water and causing the compounds to evaporate.

Aquifer: An underground rock formation made of materials like sand, soil, or gravel that can store and supply *groundwater* to wells and springs. Most aquifers used in the U.S. are within a thousand feet from the earth's surface.

Carcinogen: A substance that causes cancer.

Carbon Adsorption: A treatment system where contaminants are removed from groundwater or surface water when the water is forced through tanks containing activated carbon, a specially treated material that attracts the contaminants.

Cleanup: Actions taken to deal with a release or threatened release of *hazardous substances* that could affect public health or the environment. "Cleanup" is often used broadly for various *response actions* or phases of the *remedial responses.*

Comment Period: A time period during which the public can review and comment on various documents and proposed *cleanup* plans. A comment period is provided when EPA proposes to add sites to the *National Priorities List (NPL).* Also, a minimum 30-day comment period is held for community members to review and comment on a draft *feasibility study.*

Community Relations (CR): The State and EPA's program to inform and involve the public in the Superfund process and respond to community concerns.

CERCLA: (Comprehensive Environmental Response, Compensation and Liability Act) A Federal law passed in 1980 and modified in 1986 by *SARA.* The acts created a special tax that goes into a *trust fund,* commonly known as *Superfund,* to investigate and clean up abandoned or uncontrolled hazardous waste sites. Under the program, EPA can either:

♦ Pay for site cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work.

♦ Take legal action to force parties responsible for site contamination to clean up the site or pay back the Federal government for the cost of the cleanup.

Consent Decree: A legal document, approved and issued by a judge, that formalizes an agreement reached between EPA/State and *potentially responsible parties (PRPs)* where PRPs will perform all or part of a *Superfund* site cleanup. The consent decree describes actions that PRPs are required to perform and is subject to a public *comment period.*

Contract Lab Program: Laboratories under contract to EPA which analyze soil, water, and waste samples taken from *Superfund* Sites.

Cost-Effective Alternative: The *cleanup* alternative selected for a site on the *National Priorities List (NPL)* based on technical feasibility, performance, reliability, and cost. The selected alternative does not require EPA to choose the least expensive alternative, but requires that if several alternatives are available that deal effectively with the problems at the site, EPA or the State must choose the remedy on the basis of permanence, reliability and cost.

Cost Recovery: A legal process where *PRPs* can be required to pay back the Federal government for money it spends on the *cleanup* program.

Enforcement: EPA's efforts, through legal action if necessary, to force *PRPs* to perform or pay for a *superfund cleanup*.

Enforcement Decision Document: A public document that explains the State's and EPA's selection of a cleanup alternative at a Superfund site through an *enforcement* action. Similar to a *Record of Decision (ROD).*

Environmental Response Team (ERT): EPA hazardous waste experts who provide 24-hour technical assistance to EPA regional offices and States during all types of emergencies involving releases at hazardous waste sites or toxic spills.

Feasibility Study (FS): A study done after the *remedial investigation* that reviews options for cleaning up the site.

Groundwater: Water found beneath the earth's surface that pores between materials like sand, soil, or gravel. In *aquifers,* groundwater occurs in sufficient quantities that it can be used for drinking water, irrigation and other purposes.

Hazard Ranking System (HRS): A scoring system that is used to evaluate potential relative risks to public health and the environment from releases or threatened releases of *hazardous substances.* EPA and States use the HRS to calculate a site score, from 0 to 100, based on the actual or potential release of hazardous substances from a site through air, surface water, or groundwater to affect people or the environment. The HRS score

determines whether a site will be added to the *National Priorities List (NPL).*

Hazardous Substance: Any material that poses a threat to public health and/or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive.

Hydrology: The science dealing with properties, movement, and effects of water on the earth's surface, in the soil and rocks below, and in the atmosphere.

Incineration: Burning of certain types of solid, liquid, or gaseous materials under controlled conditions to destroy hazardous waste.

Information Repository: A file containing current information, technical reports, and reference documents regarding a *Superfund* site. The information repository is usually located in a public building that is convenient for local residents - like a library, city hall, or public school.

Leachate: A contaminated liquid resulting when water trickles through waste materials and collects components of those wastes. Leaching may occur at landfills and may result in *hazardous substances* entering soil, *surface water,* or *groundwater.*

Monitoring Wells: Special wells drilled on or near a hazardous waste site where *groundwater* can be sampled to determine the direction in which groundwater flows, and the types and amounts of contaminants present.

National Oil and Hazardous Substances Contingency Plan (NCP): The Federal regulation that guides the *Superfund* program.

National Priorities List (NPL): EPA's list of the most serious uncontrolled or abandoned hazardous waste sites that qualify for cleanup using Federal funds.

National Response Center: The center operated by the U.S. Coast Guard that receives and evaluates reports of oil and hazardous substance releases into the environment and notifies the appropriate agencies. The NRC can be contacted 24-hours a day, toll-free at (800) 424-8802.

National Response Teams: Representatives of 12 Federal agencies that coordinate Federal responses to nationally significant pollution incidents and provide assistance to the responding agencies.

On-Scene Coordinator (OSC): The Federal official who coordinates and directs Superfund *removal actions.*

Operable Unit: An action taken as one part of an overall site cleanup.

Operations and Maintenance (O&M): Activities conducted at a site after a *response action* occurs, to ensure that the cleanup or containment system is functioning properly.

Parts Per Billion (ppb)/Parts Per Million (ppm): Units commonly used to express low concentrations of contaminants. For example, 1 ounce of a chemical in 1 million ounces of water is 1 ppm; 1 ounce of the chemical in 1 billion ounces of water is 1 ppb. If one drop of the chemical is mixed in a competition-size swimming pool, the water will contain about 1 ppb of the chemical.

Potentially Responsible Parties (PRPs): Any individual or company (such as owners, operators, transporters, or generators) potentially responsible for, or contributing to, the contamination problems at a site. Whenever possible, EPA and the State require PRPs to clean up hazardous waste sites they have contaminated.

Preliminary Assessment (PA): The process of collecting and reviewing available information about a known or suspected hazardous waste site. EPA and States use this information to determine if the site requires further study. If so, a *site inspection (SI)* is performed.

Quality Assurance/Quality Control (QA/QC): A system of procedures, checks, audits, and corrective actions used to ensure that field work and laboratory analysis during the investigation and cleanup of Superfund sites meet established standards.

Record of Decision (ROD): A public document that explains which cleanup alternative(s) will be used for a *National Priorities List (NPL)* site. The ROD is based on information generated during the *Remedial Investigation/Feasibility Study* and the *Community Relations Program* for the site.

Regional Response Team: Representatives of Federal, State, and local agencies who may assist in coordination of activities at the request of the *On-Scene Coordinator* or *Remedial Project Manager* before and during response actions.

Remedial Action (RA): The actual construction or implementation phase that follows the *remedial design* of the selected cleanup alternative at a site.

Remedial Design (RD): An engineering phase that follows the *Record of Decision* when technical drawings and specifications are developed for the subsequent *remedial action* at a site.

Remedial Investigation//Feasibility Study (RI/FS): Two distinct but related studies. They are usually performed at the same time, and referred to as the RI/FS. The RI/FS is intended to:

♦ Gather the data necessary to determine the type and extent of contamination at a *Superfund* site.

♦ Establish criteria for cleaning up the site;

♦ Identify, and screen *cleanup* alternatives or *remedial action;* and

♦ Analyze in detail the technology and costs of the alternatives.

Remedial Project Manager (RPM): The EPA or State official responsible for overseeing *remedial response* activities.

Remedial Response: A long-term action that stops or substantially reduces a release or threatened release of *hazardous substances* that is serious, but does not pose an immediate threat to the public or the environment.

Removal Action: An immediate action taken over the short-term to address a release or threatened release of *hazardous substances.*

Resource Conservation and Recovery Act (RCRA): A Federal law that established a regulatory system to track hazardous substances from the time of generation to disposal. The law requires safe and secure procedures to be used in treating, transporting, storing, and disposing of hazardous substances. RCRA is designed to prevent new uncontrolled hazardous waste sites.

Response Action: A CERCLA-authorized action at a Superfund site involving either a short-term *removal action* or a long-term *remedial response* that may include, but is not limited to, the following activities:

♦ Removing hazardous materials from a site to an EPA-approved, licensed hazardous waste facility for treatment, containment, or destruction.

♦ Containing the waste safely on-site to eliminate further problems.

♦ Destroying or treating the waste on-site using *incineration* or other technologies.

♦ Identifying and removing the source of *groundwater* contamination and preventing further movement of the contaminants.

Responsiveness Summary: A summary of oral and/or written public comments received by the State or EPA during a *comment period* on key recommendations for site cleanup, and the State/EPA response to those comments. The Responsiveness Summary highlights key community concerns and public involvement.

Risk Assessment: An evaluation performed as part of the *remedial investigation* to assess conditions at the site and determine the risk posed to public health or the environment.

Site Inspection (SI): A technical phase that follows a *preliminary assessment* designed to collect more extensive information on a hazardous waste site. The information is used to score the site with the *Hazard Ranking System (HRS)* to see if a response action is needed.

Superfund: The common name used for the Comprehensive Environmental Response, Compensation, and Liability Act. Also referred to as the *trust fund.*

Superfund Amendments and Reauthorization Act (SARA): Modifications to CERCLA, enacted on October 17, 1986.

Surface Water: Bodies of water that are above ground, such as rivers, lakes, and streams.

Treatment, Storage, and Disposal Facilities (TSDs): Any building, structure, or installation where a *hazardous substance* has been treated, stored, or disposed. TSD facilities are regulated by EPA and States under the *Resource Conservation and Recovery Act (RCRA).*

Trust Fund: A fund set up under the Superfund Law (CERCLA) to help pay for the cleanup of hazardous waste sites and to take legal action to force those who are responsible for the sites to clean them up.

Volatile Organic Compound: an organic (carbon-containing) compound that evaporates (volatizes) readily at room temperature.

Superfund Acronyms

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

CR: Community Relations

FS: Feasibility Study

HRS: Hazard Ranking System

NCP: National Oil and Hazardous Substances Contingency Plan

NPL: National Priorities List

OSC: On-Scene Coordinator

O&M: Operations & Maintenance

ppm/ppb: Parts per Million/Parts Per Billion

PRP: Potentially Responsible Party

PA: Preliminary Assessment

ROD: Record of Decision

RD/RA: Remedial Design/Remedial Action

RI: Remedial Investigation

RPM: Remedial Project Manager

SARA: Superfund Amendments and Reauthorization Act of 1986.

APPENDIX E

Index of Documents for the Administrative Record File.

U.S. TITANIUM SITE
ADMINISTRATIVE RECORD FILE *
INDEX OF DOCUMENTS

I. SITE IDENTIFICATION

1) Report: Water Well Completion Report, prepared by the Division of Mineral Resources, Commonwealth of Virginia, 9/15/66. P. 100001-100003.

2) Letter to Mr. David Olson, American Cyanamid Company, from Mr. Frank DeLuca, Geraghty & Miller, Inc., re: Results of river contamination investigation, 11/19/71. P. 100004-100013. The following are attached:

   a) a test-interceptor well locations map;
   b) the ph value samples results;
   c) an American Cyanamid Company map;
   d) an American Cyanamid Company sampling stations map.

3) Report: Documentation of Fish Kill Investigation at the Piney River Plant, prepared by the Commonwealth of Virginia, 8/31/71. P. 100014-100202. The following are attached:

   a) a Fish Kill Investigation Report;
   b) a letter requesting payment for the cost of the fish kill;
   c) a Fish Kill Report including expense sheets;
   d) three Fish Kill Reports;
   e) a memorandum regarding another fish kill.

4) Report: Evaluation of Copperas Contamination at the American Cyanamid Company Plant Site, prepared by Geraghty & Miller, Inc., 5/72. P. 100203-100225.

5) Report: Final Report on Evaluation of Environmental Pollution Control Measures for Copperas Pile Run-off, prepared by American Cyanamid Company, 7/27/72. P. 100226-100240.

* Administrative Record File available 7/26/89.

Note: Company and organizational affiliation is identified in the index only when it appears in the file.

6) Letter to Mr. D.C. Praeger, Virginia State Water Control Board, from Mr. J.F. Hopkins, American Cyanamid Company, re: Transmittal of the plan for abatement of pollution due to run-off, 10/31/72. P. 100241-100244.

7) Letter to Mr. J.F. Hopkins, American Cyanamid, from Mr. Millard Robbins, Bureau of Applied Technology, re: Approval of run-off plan in accordance with the March 12, 1973 memorandum, 4/10/73. P. 100245-100247. The memorandum regarding the run-off of waste at the site is attached.

8) Letter to Mr. Tedd H. Jett from Mr. Vance Wilkins, Jr., re: Transmittal of the Application for a State No-Discharge Certificate, 10/21/74. P. 100248-100251. The application and two site maps are attached.

9) Letter to Mr. Fred L. Fox, Geonics, from Mr. Tedd Jett, Virginia State Water Control, re: Transmittal of a water well completion report, 1/17/79. P. 100252-100255. The report is attached.

10) Letter to Mr. Henry A. Williams, United States Titanium, from Mr. Fred Fox, Geonics, re: Preliminary Evaluation of Proposed Copperas Disposal Area, 1/7/79. P. 100256-100257.

11) Letter to Mr. Tedd H. Jett, Virginia State Water Control Board, from Mr. Fred Fox, Geonics, re: Authorization from U.S. Titanium to have a copy of a report sent, 2/12/79. P. 100258-100269. A letter regarding logs for five test borings and ten test hole logs are attached.

12) Letter to Mr. Henry A. Williams, U.S. Titanium, from Mr. Fred Fox, Geonics, re: Site Evaluation Study for Proposed Copperas Disposal, 5/1/79. P. 100270-100273. Two maps of the proposed site are attached.

13) Letter to Mr. Robert H. Forman, Virginia State Department of Health from Mr. Tedd Jett Virginia Water Control Board, re: Transmittal of two copies of the application by Geonics for a permit on a proposed disposal site, 8/5/79. P. 100274-100288. A letter regarding the evaluation of the proposed copperas disposal site, the site evaluation form, the application for a permit to operate a solid waste disposal site, a letter regarding the site evaluation study and two site maps are attached.

14) Letter to Mr. H.A. Williams, U.S. Titanium Corp [sic] from Mr. William F. Gilley, re: Burial waste material permit, 3/11/80. P. 100289-100298. The following are attached:

    a) a memorandum regarding the copy of the permit certificate;
    b) a recommendation for the permit to be issued;
    c) a letter regarding the need for monitoring wells and fertilizers at the proposed site;
    d) a copy of the Application For A Permit to operate a solid waste disposal system;
    e) a letter regarding the proposed plan of disposal.

15) Letter to Mr. John Drew, U.S. Titanium, from Mr. Fred Fox, Geonics, re: Installation of two monitor wells and excavation of a test cell and burial of copperas, 5/13/80. P. 100299-100301. A site map is attached.

16) Letter to Mr. John Drew, U.S. Titanium, from Mr. Fred Fox, Geonics, re: Completion of test cell, 6/2/80. P. 100302-100303.

17) Letter to Mr. William F. Gilley, Virginia Division of Solid and Hazardous Waste Management, and Mr. Robert Forman, Commonwealth of Virginia, from Mr. Stephen C. Martin, re: Residents' concern of copperas burial, 7/25/80. P. 100304-100305.

18) Letter to Mr. John Drew, Mason, Drew & Dragat, from Mr. Stephen C. Martin, re: Public concerns for proper copperas burial, 8/8/80. P. 100306-100308.

19) Letter to Mr. Fred L. Fox, Geonics, from Mr. Tedd H. Jett, Virginia State Water Control, re: Routine monitoring at the Copperas burial site, 10/30/80. 100309-100310.

20) Report: A Preliminary Assessment of U.S. Titanium, prepared by Ecology and Environment, Inc., 11/30/80. P. 100311-100348.

21) Memorandum to File, from Mr. Tedd H. Jett, Virginia State Water Control Board, re: Summary of the U.S. Titanium Corporation project, 11/12/80. P. 100349-100352.

22) Letter to Mr. John Drew, Mason, Drew & Dragat, from Mr. Fred L. Fox, Geonics; re: Leveling and removal of Copperas and calculating costs, 11/17/80. P. 100353-100353.

23) Letter to Mr. Fred L. Fox, Geonics, from Mr. Tedd H. Jett, Virginia State Water Control Board, re: Geonics proposed course of action, 11/25/80. P. 100354-100357.

24) Memorandum to Mr. W.F. Gilley, Virginia Department of Health from Mr. Robert Forman, Virginia Department of Health, re: Weekly and bi-weekly inspections, 2/20/81. P. 100358-100361. Two site maps are attached.

25) Report: Fish Kill Report /Notification, prepared by the Virginia State Water Control Board, 5/22/81. P. 100362-100378. The following are attached:

a) a memorandum regarding the fish killed;
b) a Replacement Cost of Fish Summary;
c) a Total Cost Summary;
d) a laboratory costs form;
e) a memorandum regarding the fish kill complaint;
f) a summary of fish;
g) four area maps;
h) a statement on the fish kill;
i) four expense reports.

26) Report: Fish Kill Report/Notification, prepared by the Virginia State Water Control Board. 6/23/81. P. 100379-100397.

27) Report: Field Trip Summary Report, prepared by U.S. EPA, 7/81, p. 100398-100408. A Preliminary Assessment is attached.

28) Memorandum to Mr. Walter Gulevich, Virginia Department of Health, from Mr. Robert H. Forman, Virginia Department of Health, re: Investigation of Leachate problems, 9/9/81. P. 100409-100409.

29) Letter to Mr. R. Bradley Chewning, Virginia State Water Control Board, from Mr. Robert Murphy, Nelson County Board of Supervisors, re: Resolution by Nelson County urging proper action maintenance of Copperas burial site, 11/13/81. P. 100410-100412. The resolution is attached.

30) Letter to Mr. Robert M. Murphy, Nelson County Board of Supervisors, from Mr. Tedd H. Jett, Virginia State Water Control Board, re: Results of well monitoring, 12/16/81. P. 100413-100421. The following are attached:

    a) a map of the site showing monitoring wells;
    b) the chemical analysis reports for well #1, 5, 6A, 7A;
    C) the chemical analysis reports for Piney River #1 and #2.

31) Report: Proposal for Establishing an Vegative Cover Critical Eroding Area, prepared by U.S.D.A. [sic] Soil Conservation Service, 3/82. P. 100422-100426.

32) Letter to Mr. Tedd H. Jett, from Mr. Mark H. Kroenig, Envirodyne Engineers, re: Transmittal of a paper on scientific methods in industrial waste disposal projects, 5/13/82. P. 100427-100449. The paper is attached.

33) Letter to Mr. Ted [sic] Jett, Virginia Water Control Board, from Mr. Gerald D. McCart, Virginia Cooperative Extension Service, re: Recommendations based on sludge analysis, 5/19/82. P. 100450-100453. The sample analysis results are attached.

34) Letter to Mr. Ted [sic] Jett, Virginia Water Control Board, from Mr. G.C. McCart, Virginia Cooperative Extension Service, re: Transmittal of soil test results, 5/26/82. P. 200454-100457. The Soil Test Reports for Samples HST 1, HST 2, HST 3, HST 4, HST 5, HST 6, HST 7, HST 8, HST 9, HST 10, HST 11, HST 12, and HST 13 are attached.

35) Memorandum to Mr. Howard Wilson, U.S. EPA, from Mr. H. Ronald Peterson, U.S. EPA, re: Transmittal of the results of metal analyses, 8/23/82. P. 100458-100471. The following are attached:

a) a Chain of Custody Record;
b) a Federal Express receipt;
c) a Routing and Transmittal Slip;
d) a sample tag;
e) the Analysis Request and Result Forms for Sample Numbers UST-W2, UST-W5, UST-W6, UST-W8, UST-R2, UST-R1, UST-L1, UST-W7, and UST Blank: W8.

36) Memorandum to Mr. Ron Preston, U.S. EPA, from Mr. Howard Wilson, U.S. EPA, re: Request for metals analyses of two sediment samples, 8/25/82. P. 100472-100477. The following are attached:

a) the Analysis Request and Result Forms for Samples UST-S5 and UST-S3;
b) a memorandum regarding the transmittal of sample metals analysis results;
c) the Analysis Request and Result Forms for Samples UST-S-3 and UST S-5.

37) U.S. EPA Site Inspection Report, 8/25/82. P. 100478-100487.

38) Letter to Mr. Frank J. Quirus, Ecology & Environment, Inc., from Mr. K. R. Hinkle, Virginia State Water Control Board, re: Transmittal of information on depth to bedrock at the U.S. Titanium Site, 8/22. P. 100488-100490. The monitoring well data is attached.

39) Memorandum to Ms. Janet E. Roberson, U.S. EPA, from Mr. H. Ronald Preston, U. S. EPA, re: Transmittal of the results of metals analyses, 9/8/82. P. 100491-100506. The following are attached:

    a) a letter regarding request for additional quantitative metals analyses;
    b) the Analysis Request and Result Forms for Sample Numbers UST-S5, UST-S3, UST-S-3, UST-S-5, UST-W2, UST-W5, UST-W6, UST-W8, UST-R2, UST-R1, UST-L1, UST-L2, UST-W7, and UST Blank: W8.

40) Memorandum to File from Mr. Howard O. Wilson, U.S. EPA, re: Lagoon sediment samples, 9/23/82. P. 100507-100512. A Case History-Land Application/Treatment of Residue Produced in the manufacture of Titanium Dioxide is attached.

41) Handwritten cover page re: Sample Traffic Reports, 11/10/82. P. 100513-100534. The Inorganics Traffic Reports for Sample Numbers MC 9630, MC 9631, MC 9632, MC 9633, MC 9634, MC 9635, MC 9446, MC 9648, MC 9649, MC 9650, MC 9651, MC 9652, MC 9653, MC 9654, MC 9655, MC 9656, MC 9657, MC 9658, and MC 9662 and two Chain of Custody Records are attached.

42) Report: Boring Logs, (no author cited), 11/16/82. P. 100535-100541.

43) Report: Site Inspection Report: U.S. Titanium Property, Piney River, Virginia, prepared by Mr. Howard O. Wilson, Mr. George H. Houghton, and Mr. Eric Johnson, U.S. EPA, 11/19/82. P. 100542-100576.

44) Handwritten site diagram, U.S. Titanium Site, Piney River, Virginia, 11/29/82. P. 100577-100712. The following are attached:

    a) a Monitoring Well Physical Data Table;
    b) the results of groundwater sampling;
    c) the graphical representations of groundwater quality results;
    d) a table showing ph versus Depth of hand Augering;
    e) an analysis of sedimentation pond material;
    f) a boring log;

g) an analysis of leachates and auger hole water;
h) the soil testing results;
i) the effluent analysis from permeability testing;
j) the site drainage and Piney River water quality data;
k) a graphical representation of neutralization requirements for selected soil samples.

45) Report: Interim Report for U.S. Titanium, prepared by Mr. Douglas Taylor, and Mr. Joseph G. McGovern, Ecology and Environment, Inc., 12/10/82, P. 100713-100825.

46) Letter to Dr. Malcolm Tenney, Jr., from Mr. R. Bradley Chewning, Virginia State Water Control Board, re: Transmittal of the draft Site Inspection Report for the U.S. Titanium Site, 1/4/83. P. 100826-100861. A letter regarding the draft Site Inspection Report and the report are attached.

47) Pesticide Analysis Data, 2/12/83. P. 100862-100882.

48) Report: Case Summary Quality Control Reports, prepared by WCTS, Inc., 2/24/83. P. 100883-101211. The following are attached:

a) a Chain of Custody Record;
b) three quality control reports;
c) a case review quality control reports summary of outliers;
d) a cross reference table;
e) a volatile internal standard areas sheet;
f) a semivolatile internal standard areas sheet;
g) a GC screen data sheet;
h) the quality control reports for Sample Numbers: C2737, C2737MS, C2737MSD, C2745, C2745MS, C2745MSD, C2746, and C2747 M.B.;
i) the organics analysis data sheets for blank samples;
j) the volatile initial calibration data;
k) an I.T. Analytical Services Quantitation Report for Sample: 50 UG/L 6582 VOA Screening Standard;

l) an I.T. Analytical Services Quantitation Report for Sample: 25 UG/L 6582 VOA Screening Standard;
m) an I.T. Analytical Services Quantitation Report for Sample: 2000 UG/L 6582 VOA Screening Standard;
n) a mass list and mass spectrum for sample number 50 NG BFB;
o) a VOA calibration check compounds sheet;
p) two VOA standard check forms;
q) an I.T. Analytical Services Quantitation Report, Sample: 50 UG/L 6582 VOA Screening Standard;
r) a FSCC Initial Calibration Data;
s) a GC/MS Performance Standard;
t) a mass chromatograms, mass spectrums, and mass list for sample: Fused silica selectivity;
u) a Quantitation Report for Sample: 50 UG/ML 6582 B/N/A/P Screening Standard;
v) a Quantitation Report for Sample: 25 UG/ML 6582 B/N/A/P Screening Standard;
w) a Quantitation Report for Sample: 100 UG/ML 6582 B/N/A/P Screening Standard;
x) a Quantitation Report for Sample: 200 UG/ML 6582 BNA Screening Standard;
y) a Quantitation Report for Sample: 200 UG/ML 6582 HAZ-P-B(K)FL Screening Standard;
z) a GC /MS Performance Standard;
aa) a mass chromatograms, mass spectrums, and mass list for sample: Fused silica selectivity;
bb) a Quantitation Report for Sample: 50 UG/ML 6582 B/N/A/P Screening Standard;
cc) eight I.T. Analytical Services Quantitation Reports for Sample Numbers Lab Blank, C2737, C2737 Matrix Spike, C2737 Duplicate Spike,C2745, C2746 (1:10 Dilution), C2747, and C2747 (1:100 Dilution);
dd) seven Quantitation Reports for Sample Numbers Method Blank, C2737, C2745, C2745 Matrix Spike, C2745 Duplicate Spike, C2746, and C2747;
ee) a Capillary Pesticides Data.

49) WCTS Sample Log-in Sheet-Waters for Sample Numbers C2737, C2745, C2746, and C2747, 2/25/83. P. 101212-101217. A description of laboratory procedures is attached.

50) GC Screen Data Sheet for Samples MB, C2737, C2745, C2746, and C2747, 2/26/83. P. 101218-101230. Test results of BNA screens are attached.

51) TCDD Raw Data Summary Sheet for Sample Numbers STANDARD, METHOD BLANK, C2737, C2737MS, C2737MSD, C2745, C2746, and C2747, 3/20/83. P. 101231-101247. A mid mass chromatograms and a mid mass spectrums are attached.

52) Report: Biological Monitoring Report, (no author cited), Virginia, 6/6/83. P. 101248-101260. A Draft Statement of Work for the Supplemental Remedial Investigation is attached.

53) Report: Site Inspection of U.S. Titanium, prepared by NUS Corporation, 7/27/83. P. 101261-101325. References are listed on P. 101324.

54) Report: A Toxicological Impact Assessment of U.S. Titanium Corporation Property, prepared by NUS Corporation, 8/11/83. P. 101326-101357.

55) Sample Data Summary: Target Compounds, Inorganic, for Sample Numbers MC-1653, MC-1654, MC-1655, MC-1656, MC-1657, MC-1658, MC-1659, MC-1660, MC-1661, MC-1662, MC-1663, and MC-1664, 11/9/83. P. 101358-101404. The following are attached:

    a) a Sample Data Summary: Target Compounds, Organic, for Sample Numbers C3409, C3410, C3411, C3412, C3413, C3414, C3415, C3416, C3417, C3418, C3419, and C3420;
    b) Organic Analysis Data Sheets for Sample Numbers C3409, C3410, C3411, C3412, C3413, C3414, C3415, C3416, C3417, C3418, C3419, and C3420;
    c) Quality Assurance Notices for Samples C3409, C3410, and C3420;
    d) Inorganics Analysis Data Sheets for Samples MC1653, MC1654, MC1655, MC1656, MC1657, MC1658, MC1659, MC1660, MC1661, MC1662, MC1663, and MC1664.

56) Report: A Study of The U.S. Titanium Site in Nelson County, Virginia, prepared by Virginia Polytechnic Institute & State University, 3/84. P. 101405-101438. References are listed on P. 101415.

57) Report: Evaluation of The Hazardous Waste Site at The U.S. Titanium Plant in Piney River, prepared by Mark S. Morris, Virginia Polytechnic Institute and State University, 7/84. P. 101439-101618. References are listed on P. 101521.

58) Memorandum to Mr. Daniel K. Donnelly, U.S. EPA, from Mr. Kirby K.F. Worthington, U.S. EPA, re: Transmittal of the results of energy dispersive X-ray fluorescence scans of samples, 8/16/84. P. 101619-101643. The following are attached:

    a) a memorandum regarding testing of samples for pesticides and/or PCBs;
    b) the Analysis Request and Result Forms for Sample Numbers UST-W8, UST-S1, UST-S2, UST-R1, UST-R2, UST-01, UST-S3, UST-S4, UST-W5, UST-S6, UST-W2, UST-W6, UST-S5, UST-L2, UST-R01, and UST-W7;
    c) three James River Basin Forms;
    d) a Piney River Data Form;

59) Letter to Mr. Don Neal, GCA Inc., from Mr. Tedd H. Jett, Virginia State Water Control Board, re: Background flow and water quality data, 8/28/84 P. 101644-101650. The following are attached:

    a) a gage records for water years 1981-1983;
    b) a letter regarding transmittal of the results of a cursory benthic survey;
    c) two biological monitoring reports of the Piney River in Virginia.

60) Letter to Mr. Don Neal, GCA Inc., from Mr. Tedd H. Jett, Virginia State Water Control Board, re: Transmittal of a qualitative biological survey report for the Piney River, 9/27/84 P. 101651-101663. The report is attached.

61) Letter to Ms. Carol Stokes, U.S. EPA, from Mr. Tedd H. Jett, Virginia State Water Control Board, re: Transmittal of two Masters Theses written at Virginia Polytechnic Institute, 10/25/84. P. 101664-101797. The Thesis of Ms. Jaleh Moslehi is attached. References are listed on P. 101794-101796.

62) Memorandum to Mr. R.F. Tesh, from Mr. R.W. Bolgiano, Virginia State Water Control Board, re: A cursory benthic survey conducted on the Piney River, 6/27/85. P. 101798-101809. The Qualitative Benthic Survey, Piney River, Nelson County, James River Basin is attached.

63) Letter to Mr. James M. Seif, U.S. EPA, from Mr. W.R. Meyer, Virginia State Air Pollution Control Board, re: Request for an EPA Field Investigation Team at the U.S. Titanium Site, 10/10/85. P. 101810-101815. The following are attached:

    a) a letter regarding transmittal of sample analytical results;
    b) the analytical results for samples collected at Piney River Plant Site;
    c) a handwritten site diagram;

64) Report: A Field Trip Report for the U.S. Titanium Corporation, Draft, prepared by NUS Corporation, 2/19/86. P. 101816-102166.

65) Report: Review of Proposed Environmental Protection Agency (EPA) Study of the U.S. Titanium Site, Nelson County, Virginia, prepared by the U.S. Geological Survey, (undated). P. 102167-102173. References are listed on P. 102173.

66) Assorted handwritten notes on the U.S. Titanium Site, (undated). P. 102174-102177.

67) Inventory Sheet of U.S. Titanium, (undated). P. 102178-102220. The following are attached:

    a) a Technical Direction Document;
    b) a Technical Direction Document with a record of telephone call attached;
    c) a Dumpsite Summary Sheet;

d) the handwritten notes regarding site burial work;
e) a Preliminary Assessment of U.S. Titanium.

68) Inventory Sheet of U.S. Titanium, (undated). P. 102221-102401. The following are attached:

a) five Technical Direction Documents;
b) a handwritten sampling plan for drilling activities;
c) a Site Safety Plan for a site visit;
d) a Site Safety Plan for well drilling and sampling;
f) an equipment list;
g) the boring logs for boring numbers B-1, 2, 3, B-4, and B-5;
h) a Federal Express receipt;
i) the Inorganics Traffic Reports for Sample Numbers MC 9446, MC 9630, MC 9631, MC 9632, MC 9633, MC 9634, MC 9635, MC 9648, MC 9649, MC 9650, MC 9651, MC 9652, MC 9653, MC 9654, MC 9655, MC 9656, MC 9657, MC 9658, and MC 9662;
j) two Chain of Custody Records;
k) a Regional Internal Distribution List;
l) a letter regarding the transmittal of subcontract documents;
m) an Agreement between Ecology and Environment, Inc. and Girdler Foundation & Exploration Company;
n) a memorandum regarding verification of an attached invoice;
o) an invoice from Girdler Foundation & Exploration Co. for monitoring well installation;
p) a memorandum regarding EPA subcontract approval;
q) a Request for FIT subcontract approval;
r) a memorandum regarding the selection of a drilling subcontractor;
s) a memorandum regarding the selection and recommendation of a subcontractor;
t) a Regional Internal Distribution List;
u) a memorandum regarding the selection of a subcontractor and changes in the Scope of Work;
v) a memorandum regarding changes in the Scope of Work;

w) a letter regarding the transmittal of test borings logs;
x) five Test Hole Logs;
y) a letter regarding additional monitoring wells;
z) a letter regarding the diameter of the proposed monitoring wells;
aa) a letter regarding additional information on existing wells;
bb) a letter regarding funding and specifications of the monitoring wells;
cc) a map of the Piney River, Virginia, area;
dd) a handwritten site sketch;
ee) a letter regarding the transmittal of background information;
ff) the physical data for monitoring wells;
gg) the soil sampling data;
hh) the ground water monitoring data;
ii) two letters regarding the transmittal of monitoring well information;
jj) a price quotation sheet from Falwell Well Corporation;
kk) a site map;
ll) a letter regarding a site evaluation study of the proposed copperas disposal;
mm) a map of the Piney River, Virginia, area;
nn) a handwritten site sketch;
oo) a letter regarding the preliminary evaluation of the proposed copperas disposal area;
pp) five site sketches;
qq) handwritten field notes;
rr) a map of flood prone areas near Piney River;
ss) a Chain of Custody Record;
tt) a request from Regional FIT for NPMO/EPA approval;
uu) a memorandum regarding the transmittal of data on the proposed subcontract;
vv) a memorandum regarding the transmittal of four Technical Direction Documents.

II. REMEDIAL ENFORCEMENT PLANNING

1) Chart: Acid Recovery Plant Production Calculations Based on Analysis of Grab Samples, prepared by Mr. Stephen A. Lamanna, 2/5/48. P. 200001-200001.

2) Report: Acid Recovery Pilot Plant, prepared by Mr. Stephen A. Lamanna, 3/14/49. P. 200002-200038.

3) Memorandum to Mr. J.F. Hopkins, American Cyanamid Company, from Mr. Stephen A. Lamanna, re: Production cost estimate, Hydrated Yellow Iron Oxide "Hyferox", 1/26/65. P. 200039-200045. The Production and Cost Report are attached.

4) Letter to Mr. E. Hladky from Mr. Stephen A. Lamanna, re: Piney River Copperas-Acid Recovery, 8/23/67. P. 200046-200047.

5) Memorandum to Mr. J.F. Hopkins, Piney River Office, from Mr. Stephen A. Lamanna, re: Waste acid recovery, 8/20/68. P. 200048-200051. Two flow charts are attached.

6) Report: End Liquor Concentration Acid Recovery Operating Procedure Volume XI, prepared by Mr. Stephen A. Lamanna, Plant Chemical Engineer, American Cyanamid Company, 3/69. P. 200052-200079.

7) Memorandum to Mr. John B. Baer from Mr. Stephen A. Lamanna, re: Production of copperas, 5/8/69. P. 200080-200081. A Copperas Table is attached.

8) Memorandum to Mr. J.F. Hopkins, from Mr. Stephen A. Lamanna, re: Waste acid recovery Savannah Plant, 10/2/69. P. 200082-200086. The technical details, an end liquor (waste acid) analysis, and a flow chart for the Savannah Plant are attached.

9) Memorandum to Mr. S.A. Lamanna, Piney River Office, from Mr. Richard L. Bennett, re: Dilution of 98% H_2SO_4 with recovered Acid to form 93% Acid, 1/9/70. P. 200087-200088. A flowchart of the dilution process is attached.

10) Memorandum to Mr. S.A. Lamanna, Piney River Plant, from Mr. Richard L. Bennett American Cyanamid Company, re: Waste Acid Recovery Plant, 3/20/70. P. 200089-200090. A flow chart of a proposed pilot plant is attached.

11) Letter to Mr. J.J. Fitzgerald from Mr. J.F. Hopkins, re: Waste Acid Recovery and Neutralization, 4/29/70. P. 200091-200096. A comparison of capital costs and profit or loss for alternatives at the Piney River Plant is attached.

12) Memorandum to Mr. J.F. Hopkins from Mr. Stephen A. Lamanna, re: Waste Acid Neutralization, 7/28/70. P. 200097-200098. A flow chart of a design of a waste acid neutralization plant is attached.

13) Memorandum to Mr. J. Smodish, Mr. F.J. Stamm, and Mr. J.B. Baer from Mr. Stephen A. Lamanna, re: Copperas analysis, 9/10/70. P. 200099-200099.

14) Memorandum to Mr. Fred Stamm from Mr. Stephen A. Lamanna, re: Copperas Solution, 4/22/71. P. 200100-200102. A Specific Gravity - $FeSO_4$ chart and a handwritten table are attached.

15) Map: Copperas Dump Contour Map. P. 200103-200103.

16) Memorandum to Mr. J.F. Hopkins, Piney River Office, from Mr. Stephen A. Lamanna, re: Copperas "Dump", 4/29/71. P. 200104-200107. A drill sample analysis table, an X-ray diffraction analysis table, and a contour map are attached.

17) Letter to Mr. J.F. Hopkins, from Mr. W.R. Whately, re: Copperas Pile Effluent, 3/9/72. P. 200108-200108.

18) Memorandum to Mr: V.P. Langone, American Cyanamid Company, from Mr. R.N. Kelly, American Cyanamid Company re: Copperas Status Report and a September 9, 1972 phone request, 8/17/72. P. 200109-200111. A letter regarding a phone conversation on dry copperas is attached.

19) Letter to Mr. Jim Heenehan, U.S. EPA, from Ms. Marie C. Shultie, Delaware Department of State, re: United States Titanium Company, 6/3/82. P. 200112-200113. A list of officers, director, and registered agents is attached.

20) Letter to Mr. Edward R. Parker, American Cyanamid Company, from Mr. Thomas C. Voltaggio, U.S. EPA, re: Request for all documents relating to wastes generated by American Cyanamid Company, 1/7/83. P. 200114-200117. Two certified mail receipts are attached.

21) Letter to Mr. Ronald Penque from Mr. Thomas C. Voltaggio, U.S. EPA, re: Request of all documents relating to wastes generated by American Cyanamid Company, 1/7/83. P. 200118-200121. Two certified mail receipts are attached.

22) Letter to Mr. Paul Turner, Christian, Barton, Epps, Bunt and Chappell, from Mr. Thomas C. Voltaggio, U.S. EPA, re: Request for all documents relating to waste generated by American Cyanamid Company, 1/7/83. P. 200122-200125. Two certified mail receipts are attached.

23) Letter to Mr. S. Vance Wilkens from Mr. Thomas C. Voltaggio, U.S. EPA, re: Request for all documents relating to wastes generated by American Cyanamid Company, 1/7/83. P. 200126-200129. Two certified mail receipts are attached.

24) Letter to Mr. Henry A. Williams, II from Mr. Thomas C. Voltaggio, U.S. EPA, re: Request for all documents relating to wastes generated by American Cyanamid Company, 1/7/83. P. 200130-200133. Two certified mail receipts are attached.

25) Letter to Mr. James Heenehan, U.S. EPA, from Mr. Paul G. Turner, re: United States Titanium Corporation Request for Documents, 1/20/83. P. 200134-200136. An envelope is attached.

26) Letter to Mr. James Heenehan, U.S. EPA, from Ms. Margaret R. Tribble, American Cyanamid company, re: Virginia Request for Documents, 3/2/83. P. 200137-200137

27) Letter to Mr. James Heenehan, U.S. EPA, from Ms. Margaret R. Tribble, American Cyanamid Company, re: Virginia Request for Document, 3/2/83. P. 200138-200138.

28) Letter to Mr. Russell H. Wyer, U.S. EPA, from Ms. Margeret R. Tribble, American Cyanamid Company, re: Virginia Amendment to National Contingency Plan, 3/7/83. P. 200139-200149. A monitoring well analysis, a monitoring well analytical variability table, and a mitre model groundwater worksheet are attached.

29) Letter to Mr. Paul Turner, Christian, Barton, Epps, Bunt and Chappell, from Mr. Stephen R. Wassersug, U.S. EPA, re: Notification of action which EPA believes should be performed at U.S. Titanium Site, 7/1/83. P. 200150-200154. Two certified mail receipts are attached.

30) Letter to Mr. Ronald Penque from Mr. Stephen R. Wassersug, U.S. EPA, re: Notice of Corrective Action needed at U.S. Titanium Site, 7/5/83. P. 200155-200159. Two certified mail receipts are attached.

31) Letter to Mr. S. Vance Wilkens from Mr. Stephen R. Wassersug, U.S. EPA, re: Notice of Corrective Action needed at U.S. Titanium Site, 7/5/83. P. 200160-200164. Two certified mail receipts are attached.

32) Letter to Mr. Henry A. Williams, III, Penque-Williams, Inc., from Mr. Stephen R. Wassersug, U.S. EPA, re: Notice of corrective action needed at U.S. Titanium Site, 7/5/83. P. 200165-200169. Two certified mail receipts are attached.

33) Letter to Mr. Edward R. Parker, American Cyanamid Company, from Mr. Stephen R. Wassersug, U.S. EPA, re: Notice of Corrective Action needed at U.S. Titanium Site, 7/7/83. P. 200170-200174. Two certified mail receipts are attached.

34) Letter to Mr. Eric W. Johnson, U.S. EPA, from Mr. Henry A. Williams, III, re: Penque-Williams interest in U.S. Titanium Site, 7/9/83. P. 200175-200175.

35) Letter to Mr. Eric W. Johnson, U.S. EPA, from Mr. Paul G. Turner, Christian, Barton, Epps Bunt and Chappell, re: United States Titanium Site in Nelson and Amherst Counties, Virginia, 7/26/83. P. 200176-200178. An envelope is attached.

36) Letter to Mr. Eric W. Johnson, U.S. EPA, from Mr. Robert C. Wood, III, Edmunds & Williams, re: S. Vance Wilken's liability with regard to U.S. Titanium Site, 7/29/83. P. 200179-200180.

37) Letter to Mr. Eric W. Johnson, U.S. EPA, from Ms. Margaret R. Tribble, American Cyanamid Company, re: Corrective action at U.S. Titanium Site, Piney River, Virginia, 8/3/83. P. 200181-200181.

38) Letter to Mr. Robert E. Desmond from Mr. Stephen R. Wassersug, U.S. EPA, re: Potentially responsible party for release or threatened release of hazardous substances at U.S. Titanium Site, 10/4/85. P. 200182-200186. Two certified mail receipts are attached.

39) Letter to Mr. Barry L. Malter, Holland & Knight, from Mr. Stephen R. Wassersug, U.S. EPA, re: Potential responsible party for release or threatened release or threatened release of hazardous substances at U.S. Titanium Site, 10/4/85. P. 200187-200191. Two certified mail receipts are attached.

40) Letter to Mr. Ronald Penque from Mr. Stephen R. Wassersug, U.S. EPA, re: Potential responsible party for release or threatened release of hazardous substances at U.S. Titanium Site, 10/4/85. P. 200192-200196. Two certified mail receipts are attached.

41) Letter to Mr. Paul Turner, Christian, Barton, Epps, Bunt and Chappell, from Mr. Stephen R. Wassersug, U.S. EPA, re: Clients are potential responsible parties for release or threatened release of hazardous substances at U.S. Titanium Site, 10/4/85. P. 200197-200201. Two certified mail receipts are attached.

42) Letter to Mr. S. Vance Wilkens from Mr. Stephen R. Wassersug, U.S. EPA, re: Potential responsible party for release or threatened release of hazardous substance at U.S. Titanium Site, 10/4/85. P. 200202-200206. Two certified mail receipts are attached.

43) Letter to Mr. Henry A. Williams, III, Penque-Williams, Inc., from Mr. Stephen R. Wassersug, U.S. EPA, re: Potential responsible party for release or threatened release of hazardous substance at U.S. Titanium Site, 10/4/85. P. 200207-200211. Two certified mail receipts are attached.

44) Letter to Mr. Robert E. Desmond from Mr. James Heenehan, U.S. EPA, re: Postponement of PRP meeting, 10/11/85. P. 200212-200212.

45) Letter to Mr. Ronald Penque from Mr. James Heenehan, U.S. EPA, re: Postponement of PRP meeting, 10/11/85. P. 200213-200213.

46) Letter to Mr. S. Vance Wilkens from Mr. James Heenehan, U.S. EPA, re: Postponement of PRP meeting, 10/11/85. P. 200214-200214.

47) Letter to Mr. Robert Wood, Evans & Williams, from Mr. James Heenehan, U.S. EPA, re: Postponement of PRP meeting, 10/11/85. P. 200215-200215.

48) Letter to Mr. Barry L. Malter, Holland & Knight, from Mr. James Heenehan, U.S. EPA, re: Postponement of PRP meeting, 10/11/85. P. 200216-200216.

49) Letter to Mr. Paul Turner, Christian, Barton, Epps, Bunt and Chappell, from Mr. James Heenehan, U.S. EPA, re: Postponement of PRP meeting, 10/11/85. P. 200217-200217.

50) Letter to Mr. Henry A. Williams, III, Penque-Williams, Inc., from Mr. James Heenehan, U.S. EPA, re: Postponement of PRP meeting, 10/11/85. P. 200218-200218,

51) Flow Chart: Acid Concentrators - 2 Stage, (undated). P. 200219-200219.

52) Chart: Solubility of $FeS0_4$ in Water and Acid-Solubility of $FeCL_2$ in Water, (undated). P. 200220-200220.

53) Letter to Mr. Thomas C. Voltaggio, U.S. EPA, from Mr. Henry A. Williams, III, re: Documents pertaining to U.S. Titanium Site, (undated). P. 200221-200221.

54) Letter to Mr. Eric W. Johnson, U.S. EPA, from Mr. John Butcher, Commonwealth of Virginia, re: Transmittal of data generated in U.S. Titanium Site, 2/29/84. P. 200222-200353. The following are attached:

a) the results of the Groundwater Sampling;
b) a graphical Representation of Groundwater Quality Results;
c) the data of ph versus Depth of Hand Augering;
d) the Analysis of Sedimentation Pond Material;
e) fifteen boring logs;
f) the analysis of leachates and Auger Hole Water;
g) the soil testing results;
h) the Effluent Analysis from Permeability Testing;
i) the site drainage and Piney River Water Quality Data;
j) the Neutralization Requirements for Selected Soil Samples;

55) Letter to Mr. James T. Heenehan, U.S. EPA and Mr. John R. Butcher, Commonwealth of Virginia, from Mr. Barry Malter, Breed, Abbott & Morgan, re: Comments on the Focused Feasibility Study, 12/16/85. P. 200354-200357.

56) Letter to Mr. Barry Malter, Breed, Abbott & Morgan, from Mr. John Butcher, Commonwealth of Virginia, re: Response and comments to the December 6, 1985 letter of Mr. James Heenehan, 12/19/85. P. 200358-200360.

57) Letter to Mr. Jerome Muys, Breed, Abbott & Morgan, from Mr. John Butcher, Commonwealth of Virginia, re: Draft Statement of Work for the measures that American Cyanamid Company proposes, 2/27/86. P. 200361-200365. A cover sheet and a letter regarding comments on the Draft statements of work are attached.

58) Letter to Mr. John Butcher, Assistant Attorney General, from Mr. John Novak, Virginia Polytechnic Institute and State University, re: Current Study of Water at Piney River, 2/26/86. P. 200366-200367. The sampling data is attached.

59) Stipulation and Order In The Matter of Virginia for Commonwealth of Virginia v. United States Titanium Corporation, 5/9/86. P. 200368-200377.

60) Letter to Mr. Philip Koren, Commonwealth of Virginia, from Mr. Jerome Muys, Swidler & Berlin, re: Hydrosystem's submittal of addendum to the Feasibility Study, 7/17/89. P. 200378-200379.

61) Letter to Dr. Tim Longe, Virginia Department of Waste Management, from Mr. Jeffrey Sitler, Hydrosystems, Inc., re: Transmittal of Addendum to the Feasibility Study, 7/18/89. P. 200380-200392. The Addendum is attached.

62) Letter to Mr. Jon Horin, Virginia Department of Waste Management, from Mr. Thomas Voltaggio, U.S. EPA, re: Preferred Alternatives of the Proposed Plan, 7/24/89. P. 200393-200394.

63) Trial Memorandum In The Matter of Commonwealth of Virginia v. United States Titanium, (undated). P. 200395-200443.

64) Bill of Complaint In The Matter of Commonwealth of Virginia, vs. United States Titanium Corporation, American Cyanamid Company, Penque-Williams, Inc., (undated). P. 200444-200453.

III. REMEDIAL RESPONSE PLANNING

1) Report: Evaluation of Ferrous Sulfate Disposal Site at Piney River, Virginia, prepared by Mr. John T. Novak, Virginia Polytechnic Institute and State University, 12/29/82. P. 300001-300028.

2) Report: Remedial Action Master Plan, U.S. Titanium Site, Nelson and Amherst Counties, Virginia, prepared by NUS Corporation, 8/83. P 300029-300175. References are listed on P. 300117-300128.

3) Letter to Mr. Gene Lucero, U.S. EPA, from Mr. Bruce Blanchard, U.S. Department of the Interior, re: Preliminary natural resources survey of the U.S. Titanium Site, 1/4/84. P. 300176-300176.

4) Memorandum to Mr. Pablo Huidoboro, Mr. Robert Hall, Mr. Michael Jazinski, and Mr. Steve Konieczny from Mr. David Coglay, re: Leachate from Ferrous Sulfate Waste Piles, 1/29/85. P. 300177-300178.

5) Report: Addendum to the Endangerment Assessment/ Feasibility Study: U.S. Titanium Site, Piney River, Virginia, prepared by GCA Corporation, 9/85. P. 300179-300255. References are listed on P. 300246.

6) Letter to Ms. Carol E. Stokes, U.S. EPA, from Mr. Robert C. Wood, III, Edmunds & Williams, re: U.S. Titanium Site meeting of October 30, 1985, 10/23/85. P. 300256-300257. An envelope is attached.

7) Report: Focused Feasibility Study for the U.S. Titanium Site, prepared by PRC Engineering, 10/24/85. P. 300258-300269.

8) Letter to Ms. Carol Stokes, U.S. EPA, from Mr. Barry L. Malter, Holland & Knight, re: Comments of American Cyanamid Company on the Endangerment Assessment/Feasibility Study, 11/26/85. P. 300270-300280.

9) Report: Evaluation of Neutralization Requirements for the U.S. Titanium Site, Piney River, Virginia, prepared by PRC Engineering, 1/86. P. 300281-300307.

10) Letter to Mr. James T. Heenehan, U.S. EPA, and Mr. John R. Butcher, Commonwealth of Virginia, from Mr. Lyle R. Silka, Hydrosystems Inc., re: Proposed locations for additional monitoring wells, 1/13/86. P. 300308-300313.

11) Letter to Mr. Joel Jerome, American Cyanamid Company, from Ms. Carol Strokes, U.S. EPA, re: Comments on American Cyanamid's site proposed, 1/22/86. P. 300314-30015.

12) Report: Schedule for Additional Studies at the U.S. Titanium Site in Piney River, Virginia, 1/28/86. P. 300316-300318.

13) Letter to Mr. John R. Butcher, Commonwealth of Virginia, from Mr. Jerome C. Muys, Jr., Breed, Abbott & Morgan, re: American Cyanamid Company's Draft Statement of Work, 2/19/86. P. 300319-300330. The Draft Statement of Work is attached.

14) Letter to Mr. Jerome C. Muys, Jr., Breed, Abbot & Morgan, from Mr. John R. Butcher, Commonwealth of Virginia, re: Response to American Cyanamid Company's site proposal, 2/27/86. P. 300331-300335. A cover sheet and a letter regarding the Draft statements of work are attached.

15) Report: Focused Feasibility Study for the U.S. Titanium Site, prepared by PRC Engineering, 3/5/86. P. 300336-300349.

16) Letter to Mr. Jerome C. Muys, Breed, Abbott & Morgan, from Ms. Carol Stokes, U.S. EPA, re: Proposed measures to be undertaken by American Cyanamid, 3/31/86. P. 300350-300359. The following are attached:

    a) a letter regarding groundwater tables;
    b) an analysis of water in contact with grey material;
    C) a letter regarding comments on the States Draft Consent Decree;
    d) a Site Boring Map.

17) Report: Endangerment Assessment/Feasibility Study: U.S. Titanium Site, Piney River, Virginia, prepared by GCA Corporation, 4/86. P. 300360-300771.

18) Report: Statement of Work, Supplement Remedial Investigation at the U.S. Titanium Site, Piney River Virginia, prepared by Hydrosystems, Inc., 4/24/86. P. 300772-300794.

19) Report: Work Plan for the Supplemental Remedial Investigation at the U.S. Titanium Site, Piney River, Virginia, Revision No. 3, prepared by Hydrosystems; Inc., 9/12/86. P. 300795-300963. References are listed on P. 300854-300855.

20) Letter to Mr. Joel Jerome, American Cyanamid Company, from Mr. John R. Butcher, Commonwealth of Virginia, re: Conditional approval of the American Cyanamid Company work plan, 12/24/86 P. 300964-300968. A letter regarding EPA concerns about the work plan is attached.

21) Memorandum to Mr. R.F. Tesh, Virginia Water Control Board, from Mr. R.W. Bolgiano, Virginia Water Control Board, re: Transmittal of the U.S. Titanium/Piney River Benthic Survey, 1/8/87. P. 300969-300979. The survey is attached.

22) Report: Work Plan for the Supplemental Investigation at the U.S. Titanium Site, Piney River, Virginia, Revision No 2, Addendum No. 1, prepared by Hydrosystems, Inc., 1/9/87. P. 300980-301016.

23) Letter to Mr. Tedd Jett, Virginia Water Control Board, from Mr. Dennis P. Carney, U.S. EPA, re: U.S. Titanium Site, Supplementary Remedial Investigation (SRI) Workplan, Revision No. 2, Addendum No. 1, 2/25/87. P. 301017-301019.

24) Letter to Mr. Michael Bass, U.S. EPA, from Mr. Lyle R. Silka, Hydrosystems, Inc., re: EPA comments on the Supplementary Remedial Investigation Work Plan, 4/10/87. P. 301020-301024. A letter concerning the work plan is attached.

25) Report: Supplemental Remedial Investigation, U.S. Titanium Site, Piney River, Virginia, Volume 1 of 5, prepared by Hydrosystems, Inc., 9/17/87. P. 301025-301055.

26) Report: Supplemental Remedial Investigation, U.S. Titanium Site, Piney River, Virginia, Volume 2 of 5, prepared by Hydrosystems, Inc., 9/17/87. p. 301056-301287

27) Report: Supplemental Remedial Investigation, U.S. Titanium Site Piney River Virginia Appendixes A - G, Volume 4 of 5, prepared by Hydrosystems, Inc., 9/17/87. P. 301288-301449.

28) Report: Supplemental Remedial Investigation, U.S. Titanium Site, Piney River, Virginia, Appendixes H - Z, Volume 5 of 5, prepared by Hydrosystems, Inc., 9/17/87. P. 301450-301591.

29) Letter to Dr. James R. Miller, U.S. EPA, from Mr. Paul A. Hughes, Alliance Technologies Corporation, re: Comments on the Supplemental Remedial Investigation, 10/5/87. P. 301592-301615, The Comments are attached.

30) Letter to Mr. James Miller, U.S. EPA, from Mr. William B. Schmidt, U.S. Department of the Interior, re: Comments on the proposed Feasibility Study Work Plan, 11/5/87. P. 301616-301655. A Mine Water Research Report is attached.

31) Letter to Mr. Joel Jerome, American Cyanamid Company, from Mr. Tedd H. Jett, Virginia State Water Control Board, re: Draft Supplemental Remedial Investigation Report, 11/25/87. P. 301656-301668. The Comments are attached.

32) Letter to Mr. Garth Conner, U.S. EPA, from Mr. William B. Schmidt, U.S. Department of the Interior, re: Comments on the Supplemental Remedial Investigation Report, 12/1/87. P. 301669-301672.

33) Letter to Mr. Joel Jerome, American Cyanamid Company, from Mr. Tedd H. Jett, Virginia State Water Control Board, re: Draft Feasibility Study Work Plan, 12/7/87. P. 301673-301677. A letter regarding a study of Piney River and a sketch of groundwork profile at the tailing pond are attached.

34) Letter to Mr. Lyle R. Silka, Hydrosystems, Inc., from Mr. Tedd H. Jett, Virginia State Water Control Board, re: Transmittal of a letter report summarizing the findings at site, 12/18/87. P. 301678-301678.

35) Report: Feasibility Study Work Plan, U.S. Titanium Site, Piney River, Virginia, prepared by Hydrosystems, Inc., 1/15/88. P. 301679-301697.

36) Report: Response to Comments Submitted by the Commonwealth of Virginia and the U.S. Environmental Protection Plan for the U.S. Titanium Site, prepared by Hydrosystems, Inc., 1/15/88. P. 301698-301704.

37) Report: Response to Comments Submitted by the Commonwealth of Virginia Concerning the Supplemental Remedial Investigation of the U.S. Titanium Site, prepared by Hydrosystems, Inc., 1/15/88 P. 301705-301709.

38) Report: Response to Comments Submitted by the U.S. Environmental Protection Agency Concerning the Supplemental Remedial Investigation of the U.S. Titanium Site, prepared by Hydrosystems, Inc., 1/15/88. P. 301710-301742.

39) Letter to Mr. John R. Butcher, Commonwealth of Virginia, from Mr. Jerome C. Muys, Jr., Breed, Abbot & Morgan, re: Revised Feasibility Study Work Plan, 1/18/88. P. 301743-301744.

40) Memorandum to Mr Richard N. Burton, Virginia Department of Waste Management, from Ms. Cynthia V. Bailey, Virginia Department of Waste Management, re: Notification of Department of Waste Management's assumption of lead agency for the site clean-up, 1/21/88. P. 301745-301745.

41) Memorandum to Ms. Cynthia V. Baily, Virginia State Water Control Board, from Mr. Richard N. Burton, Virginia State Waste Control Board, re: Concurrence on Department of Waste Management's assumption of lead agency for the site, 3/7/88. P. 301746-301746.

42) Memorandum to Mr. R.F. Tesh, Virginia Water Control Board, from Mr. R.W. Bolgiano, Virginia Water Control Board, re: Transmittal of the Spring 1988 Biological Monitoring Results, 6/2/88. P. 301747-301750.

43) Letter to Mr. Joel Jerome, American Cyanamid Company, from Mr. Richard N. Burton, Virginia State Water Control Board, re: Revised Feasibility Study Work Plan, 6/15/88. P. 301757-301752.

44) Report: Volume 1 of 3, Feasibility Study, U.S. Titanium Site, Piney River, Virginia, Executive Summary, prepared by Hydrosystems, Inc., 11/10/88. P. 301753-301773.

45) Report: Volume 2 of 3, Feasibility Study, U.S. Titanium Site, Piney River, Virginia, prepared by Hydrosystems, Inc. 11/10/88. P. 301774-301909.

46) Report: Volume 3 of 3, Feasibility Study, U.S. Titanium Site, Piney River Virginia, prepared by Hydrosystems, Inc 11/10/88. P. 301910-302107. References are listed on P. 302083-302084.

47) Memorandum to Mr. R.F. Tesh, Virginia Water Control Board, from Mr. R.W. Bolgiano, Virginia Water Control Board, re: Transmittal of the Fall 1988 Biological Monitoring Results, 11/16/88. P. 302108-302113. The results are attached.

48) Letter to Mr. Brad Chewning, Virginia Water Control Board, from Mr. John Kauffman, Virginia Department of Game and Inland Fisheries, 11/21/88. P. 302114-302115.

49) Report: Health Assessment for U.S. Titanium Site, Piney River, Amherst and Nelson County, Virginia, prepared by U.S. Public Health Service, 11/29/88. P. 302116-302120.

50) Letter to Mr. Garth Connor, U.S. EPA, from Mr. James A. Barclay, U.S. Department of the Interior Bureau of Mines, re: Transmittal of comments on the Feasibility Study Report on the U.S. Titanium Site, 12/16/88. P. 302121-302125. The following are attached:

a) the comments on the Hydrosystems Feasibility Study;
b) a handwritten soil diagram;
c) an excerpt on acid mine drainage from Minerals and Materials, April/May 1988.

51) Report: Documents Reviewed, Feasibility Study, U.S. Titanium Site, Piney River, Virginia, prepared by Hydrosystems, Inc., 12/29/88. P. 302126-302129.

52) Report: Health Assessment for U.S. Titanium Site, Piney River, Amherst and Nelson County, Virginia, prepared by U.S. Public Health Service, 1/19/89. P. 302130-302135.

53) Letter to Mr. Joel Jerome, American Cyanamid Company, from Mr. Richard N. Burton, Virginia State Water Control Board, re: Comments on the Draft Feasibility Study Report, 3/15/89. P. 302136-302138. The comments are attached.

54) Report: Addendum to Feasibility Study for the U.S. Titanium Site, Piney River, Virginia, prepared by Hydrosystems, Inc., (undated). P. 302139-302176.

55) Report: Comments of American Cyanamid Company on Endangerment Assessment/Feasibility Study: U.S. Titanium Site, Piney River, Virginia, prepared by Holland & Knight, (undated). P. 302177-302395. A report entitled "Review of the Draft U.S. EPA Endangerment Assessment/Feasibility Study" is attached.

56) Letter to Mr. Ted H. Jett, Virginia State Water Control Board, from Mr. John E. Drew, Mason, Drew and Dragat, re: Transmittal of a report on waste copperas burial at Piney River, Virginia, 8/18/81. P. 302396-302401. The report is attached.

57) Memorandum to File and Mr. T.H. Jett, Virginia State Water Control Board, from J.A. Fromal, III, Virginia State Water Control Board, re: Information on the toxicity of iron salts on fresh water fish, 10/16/81. P. 302402-302402.

58) Letter to Mr. Ted [sic] Jett, Virginia State Water Control Board, from Mr. Gerald D. McCart, Virginia Cooperative Extension Service, re: Analysis of sludge samples and recommendations for treatment, 5/19/82. P. 302403-302412. The following are attached:

    a) the ground water characterization data;
    b) a memorandum regarding the biological monitoring results;
    c) the biological monitoring results and narrative.

59) Letter to Mr. Benton G. Tinder, Sr., from Mr. Tedd H. Jett, Virginia State Water Control Board, re: Transmittal of the modified Soil Conservation Service (SCS) plan and construction specifications, 5/24/82. P. 302413-302419. The plan and the specifications are attached.

60) Letter to Mr. Tedd H. Jett, Virginia State Water Control Board, from Mr. Benton G. Tinder, Sr., re: Transmittal of information regarding the proposed use of municipal sewage sludge at the U.S. Titanium site, 5/24/82. P. 302420-302422. A table of Sludge Characterization Data is attached.

61) Summary of a Soil Investigation, 5/29/82. P. 302423-302424. A sketch of the soil investigation is attached.

62) Memorandum to File from Mr. Tedd H. Jett, Virginia State Water Control Board, re: Site visit to the U.S. Titanium Corporation site, 7/25/83. P. 302425-302430. The background surface water data and four Field and Laboratory Data sheets are attached.

63) Memorandum to File from Mr. Tedd H. Jett, Virginia State Water Control Board, re: Notes of meeting held to review preliminary findings of the VPI Study, 9/1/83. P. 302431-302432.

64) Report: Evaluation of the Hazardous Waste Site at the U.S. Titanium Plant in Piney River, Virginia, prepared by Mr. Mark S. Morris, 7/84. P.302433-302744. References are listed on P. 302514. A letter regarding the transmittal of two masters theses and an additional thesis report are attached.

65) Memorandum to Mr. R.F. Tesh, Virginia State Water Control Board, and the File from Mr. R.W. Bolgiano, Virginia State Water Control Board, re: A cursory benthic survey at the U.S. Titanium site, 9/25/84. P. 302745-302756. The following are attached:

a) a Standard Rating Table;
b) a Diversity/Density Table;
c) a map of Piney River and survey area;
d) the biological field data sheets;
e) two Biological Monitoring Reports.

66) Memorandum to Mr. R.F. Tesh, Virginia State Water Control Board, from Mr. R.W. Bolgiano, Virginia State Water Control Board, re: Results of a cursory benthic survey conducted on the Piney River, 6/27/85. P. 302757-302768. A report entitled, "Qualitative Benthic Survey," is attached.

67) Report: Evaluation of Neutralization Requirements for the U.S. Titanium Site, Piney River, Virginia, prepared by GCA Corporation, 1/86. P. 302769-302795. References are listed on P. 302795.

68) Report: Draft Statement of Work, Temporary Source Control for Area 1, U.S. Titanium Site, Piney River, Virginia, prepared by Hydrosystems Inc., 2/14/86. P. 302796-302798.

69) Letter to Mr. Jerome C. Muys, Jr., Breed, Abbott & Morgan, from Mr. Tedd H. Jett, Virginia State Water Control Board, re: Deadline for a Revised Work Plan, 8/26/86. P. 302799-302802. A memorandum regarding comments on the Draft Work Plan is attached.

70) Report: Focused Feasibility Study for the U.S. Titanium Site, Revised Work Plan, prepared by Alliance Technologies Corporation, 12/5/86. P. 302803-302816.

71) Memorandum to Mr. R.F. Tesh, Virginia Water Control Board, from Mr. R.W. Bolgiano, Virginia Water Control Board, re: Results of a cursory benthic survey conducted on the Piney River, 1/8/87. P. 302817-302827. The Qualitative Benthic Survey is attached.

72) Letter to Mr. Lyle R. Silka, Hydrosystems Inc., from Mr. Tedd H. Jett, Virginia State Water Control Board, re: Transmittal of information relevant to U.S. Titanium site work, 12/7/87. P. 302828-302834. The following are attached:

    a) a Routing and Transmittal slip;
    b) three hydrographs;
    c) two water level data tables.

73) Letter to Mr. Lyle R. Silka, Hydrosystems Inc., from Mr. Tedd H. Jett, Virginia State Water Control Board, re: Transmittal of a letter report summarizing the findings of recent site investigations, 12/18/87. P. 302835-302838. A letter regarding the findings of recent site investigations and a sketch of the groundwater profile at the Tailing Pond are attached.

74) Memorandum to Mr. R.F. Tesh, Virginia Water Control Board, from Mr. R.W. Bolgiano, Virginia Water Control Board, re: Transmittal of the results of Spring 1988 Biological Monitoring and narrative, 6/2/88. P. 302839-302842. The results are attached.

75) Letter to Mr. Tim Longe, Virginia Department of Waste Management, from Mr. Jeffrey A. Sitler, Hydrosystems Inc., re: Information on possible remedial actions, 6/26/89. P. 302843-302853.

76) Letter to Mr. Jeffery [sic] A. Sitler, Hydrosystems Inc., from Dr. Timothy Longe [sic], Virginia Department of Waste Management, re: Details of remedial action alternatives, 6/29/89. P. 302854-302855.

IV. REMOVAL

1) Memorandum to Mr. Gene A. Lucero, U.S. EPA, from Stephen R. Wassersug, U.S. EPA, re: Action Memorandum for the U.S. Titanium Site, 7/19/83. P. 400001-400006. A memorandum regarding the authorization to proceed with a remedial investigation and feasibility study at the U.S. Titanium Site is attached.

V. COMMUNITY INVOLVEMENT/CONGRESSIONAL CORRESPONDENCE/IMAGERY

1) Transcript In Re: Public Hearing of the Virginia State Water Control Board, 3/16/78. P. 500001-500006.

2) Letter to Ms. Kristina Stein, Booz, Allen & Hamilton, Inc., from Mr. James R. Miller, U.S. EPA, re: Transmittal of the Draft Community Relations Plan for the U.S. Titanium Site, 1/12/88. P. 500007-500029. The Draft Community Relations Plan is attached.

SITE-SPECIFIC GUIDANCE

1) Report: Mine Water Research, Catalytic Oxidation of Ferrous Iron in Acid Mine Water by Activated Carbon, prepared by Edward A. Mihok, U.S. Department of Interior, 1969.

2) Article entitled "Microbial Dissimilatory Sulfur Cycle in Acid Mine Water", by Jon H. Tuttle, Patrick R. Dugan, Carol B. MacMillan, and Chester I. Randles, 2/69.

3) Report: Evaluation of Copperas Contamination at the American Cyanamid Company Plant Site, Piney River, Virginia, prepared by Geraghty & Miller, Inc., 5/72.

4) Report: Evaluation of Environmental Pollution Control Measures for Copperas Pile Runoff, prepared by David A. Olson, American Cyanamid Company, 7/27/72.

5) Report: Studies in the Treatment of Coal Mine Drainage by Biochemichal Iron Oxidation and Limestone Neutralization, prepared by H.L. Lovell, College of Earth and Mineral Sciences, The Pennsylvania State University, 2/28/74.

6) Report: Evaluation of Prototype Crushed Limestone Barriers for the Neutralization of Acidic Stream, prepared by Frank H. Pearson, Institute for Research on Land and Water Resources, The Pennsylvania State University, 6/74.

7) Article entitled "Limestone Barriers to Neutralize Acidic Streams", by Frank H. Pearson and Archie J. McDonnell, 6/75.

8) Article entitled "Studies of Lime-Limestone Treatment of Acid Mine Drainage", by David G. McDonald, Harry Yocum, and Alten F. Grandt, Peabody Coal Company, 1976.

9) Table of Normals, Mean, and Extremes of Outdoor Temperatures from Lynchburg and Norfolk, Virginia, 1980.

10) Report: Specifications & Contract for the Excavation and Burial of Copperas Waste, prepared by Geonics, 8/13/80.

11) Report: Project Summary: Limestone - Lime Treatment of Acid Mine Drainage - Full Scale, prepared by David G. McDonald and Alten F. Grandt, 6/81.

12) Article entitled "Modification of Acid Mine Drainage in a Freshwater Wetland", by R. Kelman Wieder and Gerald E. Lang, Department of Biology, West Virginia University, 6/26/82.

13) Report: A Study of the Interactions of Limestone and Various Acidic Solutions Containing Metal Ions, prepared by Richard L. Ranich, Department of Mineral Engineering, The Pennsylvania State University, 8/82.

14) Proposal: Engineering Evaluation of Remedial Actions at the U.S. Titanium Corporation, Piney River Site, submitted by S.L. Yu and J.M. Hamrick, Department of Civil Engineering, University of Virginia, 12/82.

15) Proposal: Evaluation of Ferrous Sulfate Disposal Site at Piney River, Virginia, submitted by Dr. John T. Novak, Department of Civil Engineering, Virginia Polytechnic Institute and State University, 12/29/82.

16) Article entitled "Biological Catalysis of the Oxidation of Iron (II) in Acid Mine Waters in a Sequencing Batch Suspended Film Reactor", by Thomas L. Theis and Lloyd H. Ketchum, Jr., Department of Civil Engineering, University of Notre Dame, and William H. Engelmann, U.S. Department of the Interior, 12/5/82.

17) Letter to John R. Butcher, Esq., Assistant Attorney General, Commonwealth of Virginia from Jim Heenehan, Esq., U.S. EPA, re: the Case Development Plan for the U.S. Titanium Site, 4/19/83. The Case Development Plan is attached.

18) Article entitled "Influence of Wetlands and Coal Mining on Stream Water Chemistry", by R. Kelman Wieder and Gerald E. Lang, Department of Biology, West Virginia University, 11/7/83.

19) Article entitled "Use of Collection Lysimeters in Monitoring Sanitary Landfill Performance", by Peter Kmet and David E. Lindorff, Wisconsin Department of Natural Resources 12/8/83.

20) Article entitled "Induced Alkaline Recharge Zones to Mitigate Acidic Seeps", by Frank T. Caruccio and Gwendelyn Geidel, Department of Geology, University of South Carolina and Ray Williams, DLM Coal Company, 12/2/84.

21) Report: Evaluation of an Acidic Waste Site Cleanup Effort, by John T. Novak, William R. Knocke, Mark S. Morris and Gregory L. Goodman, Virginia Polytechnic Institute and State University, and Tedd Jett, Virginia State Water Control Board, 5/14/85.

22) Report: The Hydrogeology of the Ferrous Sulfate Waste Site, Piney River, Nelson County, Virginia, by Steven Colton, Department of Environmental Sciences, University of Virginia, 5/1/86.

23) Report: Some Industrial Applications of Inorganic Microbial Oxidation in Japan, by T. Imaizumi, University of Tokyo, 1986.

24) Article entitled "Reclaiming Abandoned Mine Lands Using Controlled Release Bactericides: A Case Study", by Vijay Rastogi and Andrew A. Sobek, The EF Goodrich Company, 8/15/86.

25) Article entitled "Microbial Ecology and Acidic Pollution of Impoundments", by Aaron L. Mills, Department of Environmental Sciences, University of Virginia, and Alan T. Herlihy, 1985.

26) Memorandum to Lyle Silka from Gerald Lang, West Virginia University, re: article presented at the Symposium on Wetlands of the Unglaciated Appalachian Region, 01/10/86. An article entitled "Modification of Acid Mine Drainage in a Freshwater Wetland", by R. Kelman Wieder and Gerald E. Lang, Department of Biology, West Virginia University, 5/26/82 is attached.

27) Report: Benthic Macroinvertebrate Survey of the Piney River in the Vicinity of the U.S. Titanium Site, by J. Reese Voshell, Jr., Ph.D., Department of Entomology, Virginia Polytechnic Institute and State University, 1/15/87.

28) Report: Report on the Results of Filed Testing The Environmental Protection Agency's Interim Final Wetland Identification and Delineation Manual During 1987, by William S. Sipple, Office of Wetlands Protection, U.S. EPA, 4/01/88.

29) Article entitled "Theoretical Assessment and Design Considerations for Passive Mine Drainage Treatment Systems", by J. David Holm, Colorado Department of Natural Resources and deForest Guertin, Colorado School of Mines, (undated).

30) Article entitled "Constructed Wetlands for Acid Drainage Control in the Tennessee Valley", by Gregory A. Brodie, Donald A. Hammer, and David A. Tomljanovich, Tennessee Valley Authority, (undated).

31) Article entitled "Passive Mine Drainage Treatment: An Effective Low Cost Alternative", by J. David Holm, Colorado Mined Land Reclamation Division and Scott Jones, Snowmass Coal Company, (undated).

32) Article entitled "Influence of Wetlands and Coal Mining on Stream Water Chemistry", by R. Kelman Wieder and Gerald E. Lang, Department of Biology, West Virginia University, (undated).

33) Article entitled "Aquatic Plant Systems -- An Unconventional Approach to Removal of Toxic Materials", by Ray Dinges , (undated).

34) Article entitled "Observations on Iron-Oxidation Rates in Acid Mine Drainage Neutralization Plants", by Roger C. Wilmoth, James L. Kennedy, and Ronald D. Hill, U.S. EPA, (undated).

35) Article entitled "Treatment of Acid Mine Water by Wetlands", by Robert L.P. Kleinmann, Bureau of Mines, Pittsburgh Research Center, (undated).

36) Article entitled "Alkaline Injection: An Overview of Recent Work", by Kenneth J. Ladwig, Patricia M. Erickson, and Robert L.P. Kleinmann, Bureau of Mines, Pittsburgh Research Center, (undated).

37) Article entitled "Acidic Mine Drainage: The Rate-Determining Step", by Philip C. Singer and Werner Stumm, Division of Engineering and Applied Physics, Harvard University, (undated).

38) Article entitled "Passive Mine Drainage Treatment: Selected Case Studies", by J. David Holm, Colorado Department of Natural Resources and Michael B. Bischop, (undated).

39) Article entitled "Use of Limestone In AMD Treatment", by Charles T. Ford, Bituminous Coal Research, Inc., (undated).

40) Report: The Potential Importance of Sulfate Reduction Processes in Wetlands Constructed to Treat Mine Drainage, by Robert S. Hedin, Richard Hammaclr and David Hyman, (undated).

41) Report: Treatment of Acid Coal Mine Drainage with Constructed Wetlands, by Robert S. Hedin, U.S. Bureau of Mines, (undated).

42) Report: Control of Acid Mine Drainage, Preceedings of a Technology Transfer Seminar, by Staff, Bureau of Mines, (undated).

GENERAL GUIDANCE DOCUMENTS *

1) "Promulgation of Sites from Updates 1-4," Federal Register, dated 6/10/86.

2) "Proposal of Update 4," Federal Register, dated 9/18/85.

3) Memorandum to U. S. EPA from Mr. Gene Lucero regarding community relations at Superfund Enforcement sites, dated 8/28/85.

4) Groundwater Contamination and Protection, undated by Mr. Donald V. Feliciano on 8/28/85.

5) Memorandum to Toxic Waste Management Division Directors Regions I-X from Mr. William Hedeman and Mr. Gene Lucero re: Policy on Floodplains and Wetlands Assessments for CERCLA Actions, 8/6/85.

6) Guidance on Remedial Investigations under CERCLA, dated 6/85.

7) Guidance on Feasibility Studies under CERCLA, dated 6/85.

8) "Proposal of Update 3," Federal Register, dated 4/10/85.

9) Memorandum to Mr. Jack McGraw entitled "Community Relations Activities at Superfund Sites - Interim Guidance," dated 3/22/85.

10) "Proposal of Update 2," Federal Register, dated 10/15/84.

11) EPA Groundwater Protection Strategy, dated 9/84.

12) Memorandum to U.S. EPA from Mr. William Heckman, Jr. entitled "Transmittal at Superfund Removal Procedures - Revision 2," dated 8/20/84.

13) "Proposal of Updates 1," Federal Register, dated 9/8/83.

14) Community Relations in Superfund: A Handbook (interm version), dated 9/83.

15) "Proposal of First National Priority List," Federal Register, dated 12/30/02.

16) "Expanded Eligibility List," Federal Register, dated 7/23/82.

17) "Interim Priorities List," Federal Register, dated 10/23/81.

18) Uncontrolled Hazardous Waste Site Ranking System: A User's Manual, (undated).

19) Field Standard Operating Procedures - Air Surveillance (undated).

20) Field Standard Operating Site Safety Plan (undated).

* Located in EPA Region III office.